THERAPEUTICS

AND

MATERIA MEDICA.

Hoc sum contentus quod, etiamsi quomodo quidque fiat ignorem, quid fiat intelligo. . . . Quid scammoneæ radix ad purgandum, quid aristolochia ad morsus serpentum possit, video: quod satis est; cur possit nescio.

Cicero, *De Divinatione.*

THERAPEUTICS

AND

MATERIA MEDICA.

A SYSTEMATIC TREATISE

ON THE

ACTION AND USES OF MEDICINAL AGENTS,

INCLUDING THEIR

DESCRIPTION AND HISTORY.

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CONTENTS OF VOLUME II.

CLASS VI. CEREBRO-SPINAL STIMULANTS (Continued.)

CLASS VII. SPINANTS (TETANICA.)

CLASS VIII. GENERAL SEDATIVES.

CLASS IX. ARTERIAL SEDATIVES.

CLASS X. NERVOUS SEDATIVES.

CLASS XI. EVACUANTS.

CLASS XII. ALTERATIVES.

THERAPEUTICS

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ANTISPASMODICS.

ANTISPASMODICS are stimulant medicines, which control spasm by their action upon the spinal marrow. Spasm is the abnormal involuntary contraction of muscular fibre. It may be tonic or clonic. Tonic contraction is more or less persistent; clonic contraction implies alternate rigidity and relaxation of the affected muscles.

Three classes of spasmodic affections may be recognized, which arise from as many different kinds of causes.

First, and least directly related to our present subject, are those in which the blood contains a poisonous matter generated within the system, consisting of retained excreta, as in Bright's disease, idiopathic jaundice, etc.

Second, direct or indirect mechanical irritation of the nervous centres or cords, as in tetanus, gastro-intestinal and other derangements in remote organs, wounds and inflammation of the brain or spinal cord, mechanical irritation of these parts by injuries, effusions, tubercles, exostoses, and other tumors. To these may be added sudden congestion of the brain followed by exhaustion, as in violent paroxysms of passion.

Third, direct exhaustion of the system. Various causes may lead to this result. Physical fatigue produced by prolonged muscular exertion frequently occasions either general convulsions, or spasms (cramps) of those muscles which have been especially overtasked. The exhaustion following protracted mental excitement, or an intense strain of the feelings, operates in the same manner, and such is often the effect of depressing passions, of sexual excesses (in which a material loss is added to overwrought emotions), and, above all, of impoverishment of the blood, whether produced by hemorrhage, by defective nutrition, or by an imperfect supply of the vital stimuli, light and air. To these last-mentioned and indirect causes producing anæmia and the nervous diathesis must be

added the influence of insufficient muscular exercise, and the simultaneous operation of agencies tending to over-stimulate, and therefore to exhaust, the nervous system. It may be permitted to generalize these statements by saying that all spasm implies a deficiency of arterial blood in the nervous centre which controls the spasmodically contracted muscles.

All, or nearly all, of these causes abound in large cities, where the tainted atmosphere, the perpetual turmoil, the incessant activity of all the passions, and those especially which seek for gratification in luxury and ease, lower the tone of the system, blanch the skin, impair the blood, soften and waste the muscles, and at the same time so exalt the susceptibility of the nervous system that it shrinks from the impression of ordinary sensations, exaggerating, distorting, and misinterpreting them. The eye is averted from the light of day, which is shut out by delicately-tinted curtains; the ear dreads the harsh sounds of the working world, and carpets and tapestry deaden its echoes; intoxicating perfumes mask the noisome smells from surrounding decay; none but the softest and most delicate tissues and the most polished forms meet the touch, and only the most dainty food invites the fastidious palate. Modern voluptuaries, like the ancient Sybarites, would fain forbid by law all noisy crafts, and let no cock survive to disturb their morning slumbers with his "shrill clarion." The imagination meanwhile dwells in fairy land, far away from the substantial glories of nature and their invigorating power, and the passions, finding none of the nobler objects which consecrate them in the battle of life, consume the body in the fire of sensual excesses. Thus, losing more and more of its power, the whole system gradually falls into the condition of a musical instrument that is out of tune, whose keys, when struck, no longer give harmonious notes, but only jangled and discordant sounds. To use the technical, but strongly expressive, phrase, it has lost its *tone*.

This word is even more significant here than in its application to that mere relaxation, without nervous disorder, which has been described as the peculiar subject of a tonic treatment. In that case there is a loss of power; in this there is a want of harmony in the functions, and an absence of the unity which in vital processes, as in all compound actions, is essential to strength. As might be expected, from the extreme susceptibility and mobility of her nervous system, woman much more frequently than man illustrates the laws by displaying the phenomena of spasmodic affections, whether this be owing to some radical difference in her general organization from that of man, or whether it depend upon the special organs which in so striking a manner distinguish her from the opposite sex. Certain it is, that, even during the normal periodical activity of the generative function, the female exhibits a peculiar susceptibility to external impressions, and experiences internal sensations with a keenness of perception which is almost morbid. A step further and we find many women who at ordinary times betray no symptom of deranged health, but at the men-

strual epoch appear suddenly to have changed their nature; the unity and harmony of their system are broken up; each separate organ utters in its own language its peculiar cry of distress; sharp pains rack the head, the eyes refuse to bear the light, incessant buzzing or tingling noises distract the ears, spasms seize the throat and hinder swallowing, or the chest, and oppress or hurry the breathing, the abdomen, and strain it with ineffectual retching, or fill it with the racking pains of uterine colic. Every sound and sight and contact gives a new impulse to the anguish, causing involuntary startings and causeless alarms, and not unfrequently these struggles of the body end in a violent convulsion of fully-formed hysteria. The symptoms of functional nervous disorder are, indeed, almost infinite, and are really limited only by the number of perceptions of which the brain is capable. Besides those just enumerated, may be mentioned the illusions or phantasms which fill the vision, and which are often of a grotesque or frightful character; or, on the other hand, the brain may be oppressed with a lethargy like that produced by opium; sonambulism and ecstasy are also met with; the organs of the special senses may be inordinately excited, or as remarkably enfeebled; and even the muscles, both voluntary and involuntary, rigidly contracted, or a utterly relaxed as if their connection with the nervous centres had been severed.

It is a peculiarity of nervous diseases that they are, so to speak, self-generating. Their first occurrence predisposes to their perpetuation. This probably depends upon a double cause. On the one hand, it is to be observed that all employment of nervous energy is at the expense of the nutrition. Scarcely anything, hardly even a direct loss of blood, more thoroughly exhausts the strength than violent nervous commotion. Pain may kill, and so may a shock without pain. Hence every paroxysm of a convulsive nature leaves the patient languid, exhausted, feeble, inapt for and indisposed to all exertion, and consequently ever becoming more and more liable to a renewal of the attack. On the other hand, the nervous system is prone to form habits of action. A movement once performed tends to reproduce itself, at first consciously, and, by habitual repetition, unconsciously at last. The notes that were at first struck, one by one, with painful and awkward efforts, are at last formed into a flowing melody, in which the mind has no consciousness of the individual sounds. Every day, in our ordinary and habitual pursuits, we perform a thousand acts of which we take no notice, and of which we probably have no intellectual perception. Those which at first are voluntary tend, little by little, to pass into the domain of instinct, or, still further beyond the control of the will, into that of excited or reflex actions, in common with the organic movements upon which nutrition depends. Thus, by exhausting the power and therefore lowering the tone of the system, and by the tendency of all nervous acts to become habitual, disorders of the nervous system, and those especially which involve the motor function, perpetuate themselves indefinitely.

The body, with its multiplicity of organs all tending to carry it forward in life steadily and safely, is a chariot drawn by many steeds; Archæus, the charioteer, gathering their numerous reins, guides them with an unwavering hand; but whenever one more restive than the others bolts from the path or rears in the traces, the rest are thrown into confusion, and but for the soothing word, the strong curb, or the stinging lash, might dash the vehicle to pieces. The organs are united and harmonious so long, and only so long, as the tone of the system is strong enough to prevent or to repress the outbreaks of individual parts. Each leans upon the rest, and all combine to preserve and to enliven the organism; but no sooner does the moderating power of the nervous system relax, than their silent and consentaneous movements cease, and one or two, many or all the parts may be thrown into disordered action, which becomes the worse confounded and inextricable the longer it lasts. There is no greater marvel, among the wonders of the living mechanism, than the noiseless ease with which its manifold functions are performed so long as perfect health continues. But for the cravings of hunger, or the calls of nature, the man of sound constitution would not suspect that there was within him a complex and surpassingly ingenious mechanism. Weakness immediately betrays the secret. No sooner is strength impaired than each organ begins, as it were, to make its individual presence and influence felt, by its disordered movements, or by the voice of pain.

A simple reference to the first and third classes of the causes of functional spasmodic diseases which have been above enumerated, makes it plain that they are all of a depressing nature, whether they operate directly upon the nervous system through the mind, or indirectly through the blood and the function of nutrition. The second class of causes, on the other hand, comprises those which, while the organism maintains its normal vigor, excite spasm by their excessive irritation of the nervous system. In other words, spasm occurs when the power of resistance of the system is below the normal limits, although the excitant may not be excessive; and it is equally produced when the system retains its usual vigor, but is relatively weak because the excitant is greatly in excess of the normal degree. In the latter case it is evident that a treatment is called for which shall diminish the violence of the cause, if possible, and at the same time blunt the sensibility of the system to its impressions. In the former case, on the other hand, it is equally clear that the proper balance of the system is to be restored by infusing power into the exhausted nervous system, and thus bringing its parts again into harmonious action. The return of power to this system renews its tone, but its irritability at the same time declines; for the last-named quality is always in an inverse ratio to the former. This is indeed illustrated on a large scale by a comparison made between warm and cold-blooded animals. It is the former which display the least, and the latter which exhibit the greatest, degree of irritability; and, as is well known, these are always selected as the subjects of experiments intended to illustrate the

excito-motory function. Indeed, the muscular fibre of the frog forms one of the most delicate tests of the lower degrees of galvanic action. When the power which the brain possesses of regulating movement is withdrawn or impaired, excited, spinal, or convulsive actions occur under the influence of irritants which at other times would occasion no response to the muscular system. Hence it is that all spasmodic phenomena which are not directly the effect of mental influences occur most readily during sleep, and that in decapitated animals muscular spasm can be excited with the greatest facility.

Bearing in mind that two sorts of causes, alike in nature but opposite in their relation to the animal economy, may give rise to spasmodic phenomena, that the one is excessive in relation even to the average vigor of the system, and that the other may be so slight as only to manifest its operation when the nervous sensibility is morbid, it is easy to comprehend that both sedatives and stimulants may act as antispasmodics, and more particularly that medicines which in small doses excite the nervous system, but in large ones depress it, may exert such a double action. It has been seen elsewhere that this is a property of narcotics, and that opium especially, when freely administered, will control the most violent forms of certain convulsions. This it appears to do by blunting the sensibility to pain, or the irritability due to mechanical causes, such as foreign bodies in tetanus; and several antispasmodics, including ether and chloroform, act in a like manner when duly administered. But whenever spasm arises from less intense causes acting upon a highly susceptible organism, relief is not to be sought by plunging the system into a torpid state, such as narcotics produce, but by stimulating it through the gentle and peculiar action of antispasmodics. This is not the place to consider the action of those medicines which more durably sustain the nervous system at the degree of power to which antispasmodics temporarily raise it, or maintain it in that state of repose into which it is momentarily lulled by narcotics. Tonics create and permanently preserve the condition of well-being which is only simulated, and for a comparatively short time, by antispasmodics. They come into play whenever the unaided powers of the economy are not sufficient to maintain their balance and vigorous action after the morbid cause disturbing the nervous system has ceased to exert its influence.

Antispasmodics palliate and terminate spasm by an immediate and directly stimulant effect, and not, as narcotics do, by benumbing the sensibility; but their precise operation is so peculiar as to entitle them in an eminent manner to be classed alone. Undoubtedly they are nearly all stimulants when prescribed in antispasmodic doses. Ether and chloroform, and the latter especially, have been considered sedative in their operation, and justly, no doubt, when used as anæsthetics. This is emphatically true of chloroform. As regards either, however, it had long been used as a nervine, and even as a cerebral stimulant, long, indeed, before its anæsthetic powers were discovered; and even now it occasionally

displays stimulant properties alone in whatever dose it may be administered. Its associated medicine, chloroform, is not less unquestionably a stimulant of the nervous system whenever its action is restrained below the point of anæsthesia. Valerian, assafetida, castor, musk, and camphor, all produce more or less exhilaration of the mind, some increased frequency of the pulse, and some warmth of skin. Wherefore, it cannot be doubted that they all allay nervous disorder by directly stimulating the nervous centres, whether the disorder exists alone, or is associated with adynamia, or prostration depending upon pravity of the blood and the nervous exhaustion which is a consequence of such a change in the circulating fluid. The typhoid state, whether it occur in the so-called typhus and typhoid fevers, or as a phase of other febrile affections, often presents in a high degree a spasmodic derangement of the nervous system; and just in so far as it depends upon direct debility of this system, more than upon alterations in the constitution of the blood, will it be modified favorably by medicines of the present class. That is to say, when this state is developed in the course of such diseases affecting persons of a constitutionally nervous temperament, or who have become impressionable by loss of strength, or the operation of mental influences, antispasmodics will be more efficient in promoting recovery than where the ataxic phenomena depend more directly upon the special alteration of the blood which belongs to the disease, and to the disorders of function which it occasions. In such cases, that is, when ataxia grows out of adynamia resulting from profound changes in the blood, alcoholic stimulants are alone entitled to the physician's confidence. For the class of diseases now referred to, antispasmodic medicines are not as frequently used by the physicians of any other country as by those of Germany. Thus, in Great Britain and Ireland, where typhus is endemic, these remedies appear to occupy a very secondary position, if any at all, in the treatment of this disease. But we are persuaded that by keeping in view the distinction above insisted upon, and limiting their administration to cases in which ataxia depends upon the patient's constitutional susceptibility, rather than upon the morbid changes in the blood, they will be found in many cases prompt and certain remedies.

But, as has so often been repeated, antispasmodics are principally adapted to the cure of diseases which are either primarily seated in the nervous system, or in which the extraneous cause of its disorder is inconsiderable when compared with the spasm which it produces. In the former, pure antispasmodics are frequently sufficient to effect a cure, or at least to dissipate the symptoms of the existing paroxysm; but in the latter it is usually necessary to combine with them narcotics, or to employ those agents of the present class which in full doses combine an antispasmodic with a narcotic power. Thus it is of little avail to administer valerian, camphor, musk, or assafetida, to allay the agonizing spasms of the ureter in nephritic, and of the gall-ducts in biliary colic, or of the rigid uterus in parturition, while the most complete relief of pain,

and an easy discharge of the distending body, are often secured by the appropriate administration of chloroform or ether.

The disorders which antispasmodics are peculiarly adapted to relieve are both general and local, and depend upon a morbid susceptibility of the whole nervous system, or upon an exaggerated excitability of some particular part. The former of these conditions has already been referred to as that which is most common in women and in men of a delicate and feminine organization, and is usually manifested by a morbidly acute condition of the senses, and a state of the mind which leads to the exaggeration or perversion of all external impressions and all internal sensations. In its highest degree this state merges into hysteria, or into insanity when an hereditary predisposition or powerful exciting mental causes favor the production of derangement of the mind. Antispasmodics are of infinite service in the lower grades of this condition. Nothing is more astonishing in the operation of remedies than the promptness and certainty with which a dose of valerian or assafetida dispels the gloomy visions of the hypochondriac, calms the hurry and agitation of nervous excitement, allays commencing spasm, and diffuses a soothing calm over the whole being of one who but an hour before was a prey to a thousand morbid sensations, and thick-coming fancies of danger, wrong, or loss. Even on the verge of an outbreak of hysteria or frenzy, these medicines, or a dose of ether or of Hoffmann's anodyne has often sufficed to calm the rising waves of excitement, and ward off the attack.

But the success of this method depends altogether upon the predominance of a purely nervous element in the case. It is scarcely necessary to remark that neither hysterical nor maniacal excitement, which is independent of the nervous diathesis, is favorably affected by antispasmodic medicines, and least of all that which presents itself in persons of a full and plethoric habit. In such cases active bodily and mental employment, the cold bath, and purgatives are more effectual.

The local nervous disorders which are more or less curable by medicines of the present class, chiefly affect the heart and lungs, but they are, except in the case of spasmodic asthma, very seldom of a purely nervous character, and this affection is much more under the control of debilitants than of any stimulant whatever. The inhalation of anæsthetic vapors is, to some extent, an exception to this rule. In whooping-cough assafetida has been vaunted as a specific remedy, and it would appear peculiarly suited to correct the material bronchitic disorders which exist in this disease, which, however, is curable by several other and different remedies more surely than by this. There is a nervous cough which appears to be one of the innumerable manifestations of hysteria, and when it is so, antispasmodic medicines will be found to relieve it. But unless the proof of its hysterical character be very distinct, a cough may generally be referred to a material cause requiring a class of remedies different from these for its removal; and, unfortunately, there are but few well-instructed practitioners who have not been called

upon to pronounce a so-called nervous cough the evidence of an organic and incurable disease of the lungs.

But while the danger of falling into this error is insisted upon, it would be an equally gross, if a less serious mistake in every instance to attribute, not only the symptom, but its degree of severity, to the physical disease which may be present. In the case but just now referred to, a constant and harassing cough, without any reason for its existence in the seat or the extent of the laryngeal or pulmonary affection, may depend, in a great degree, upon nervous irritability, and may be palliated or even suspended for a time by a judicious combination of antispasmodics and narcotics. The same remark is applicable to those cases in which, while there is complete integrity of the respiratory organs, a cough is excited by irritation in some other organ, cases which often require a searching investigation before the real cause of the symptom can be detected. Such examples are by no means confined to the hysterical and nervous, although perhaps most frequent among them.

In other affections, also, a spasmodic and a material element are combined. A familiar example is furnished by whooping-cough, which is most efficiently treated by remedies of the expectorant class associated with antispasmodic medicines. In emphysema of the lungs a similar association frequently occurs when this disease is marked by asthmatic paroxysms, and also in many cases of organic diseases of the heart. In these and all analogous instances, remedies of the present class, and especially anæsthetic inhalations, may be prescribed with advantage.

The forms of nervous disease which affect the muscular system with debility or paralysis, are but little influenced by antispasmodic medicines. Persistent loss of power appears to be the element most opposed to their success, for it will be observed that in all cases whatever, in which they act beneficially, the phenomena are not uninterrupted, however frequently they may recur.

As might indeed be suspected, after the simple announcement of this fact, antispasmodic agents are seldom competent to effect a cure of any of the more prolonged diseases in which they are administered. They palliate the existing phenomena, and may for some time continue to do so, but their influence is transient, and in spite of the administration of increased doses, it finally ceases to be felt. Partial exceptions to this statement are found in oxide of zinc and ammoniated copper. But the former of these medicines, and perhaps the latter also, are destitute of the properties which distinguish the vegetable medicines usually associated with them, and were it not for their apparently specific influence upon the nervous system, both might be classed with tonics more appropriately than with antispasmodics. Apart, then, from these exceptions, while antispasmodic medicines exert a powerful, it is still a temporary, superficial, and palliative operation, preparing the system for the more permanent and radical influence of tonic remedies and the appliances of dietetics and hygiene.

Most of the medicines we are about to examine will be found to possess in common the singular property of a strong and penetrating odor. In two instances it is animal in its source and character, and in several more it has peculiarities which suggest its resemblance to animal rather than vegetable emanations. This is a very striking and curious fact, especially when viewed in connection with the analogy of this odor with that of ammonia, the double source of the latter in the two animated natural kingdoms, and its analogous influence on the nervous system. It cannot be that these resemblances are accidental, but to propose an explanation of them would, perhaps, lead further from the pathway of fact into the field of speculation, than would be consistent with the limits prescribed to the present work.

ALLIUM. Vid. *Expectorants.*

ASSAFŒTIDA.—ASSAFETIDA.

Description.—Assafetida is a gum-resinous exudation, obtained by incision, from the root of *Narthex Assafœtida*, an umbelliferous plant which flourishes in Persia and the adjacent countries. This fact was determined by the German traveller Kaempfer in 1687. In commerce it is met with in the form of tears, or more commonly in irregular reddish-brown masses. Its chief constituents are resin and gum, and it contains from 50 to 75 per cent. of the former and about 20 per cent. of the latter, besides nearly 4 per cent. of volatile oil.

The following are the officinal preparations of assafetida:—

EMPLASTRUM ASSAFŒTIDÆ.—*Assafetida Plaster.*

This plaster is made by incorporating assafetida and galbanum with lead plaster and wax.

MISTURA ASSAFŒTIDÆ.—*Assafetida Mixture.*

This preparation, sometimes called *lac assafœtidæ* or *milk of assafetida*, is made by triturating one hundred and twenty grains of assafetida with half a pint of water. The addition of the tincture to water produces a similar, but more stimulating mixture, which is especially adapted for use as an enema.

TINCTURA ASSAFŒTIDÆ.—*Tincture of Assafetida.*

The tincture is made by macerating, for two weeks, four troy-ounces of assafetida in two pints of alcohol, and filtering through paper. Its dose is a fluidrachm.

PILULÆ ASSAFŒTIDÆ.—*Pills of Assafetida.*

These pills are made by beating together seventy-two grains of assafetida and twenty-four of soap in fine powder, and dividing the mass into twenty-four pills. Dose, one to four pills.

PILULÆ ALOËS ET ASSAFŒTIDÆ.—*Pills of Aloes and Assafetida.*

These pills are made by beating together thirty-two grains each

of aloes, assafetida, and soap, and dividing the mass into twenty-four pills. From two to five are given at a dose.

PILULÆ GALBANI COMPOSITÆ.—*Compound Pills of Galbanum.*

Thirty-six grains each of galbanum and myrrh, and twelve grains of assafetida, are beaten up with a sufficient quantity of syrup, and divided into twenty-four pills. Each pill contains about three and a half grains of the mass. From three to five pills may be given at a dose.

History.—The name of this drug is said to have been imposed by the school of Salernum,[1] but was no doubt originally derived from the Persian *asa* or *assa*, which signifies gum.[2] The Germans call it *stercus diaboli*, while in the East it is known by a title which signifies *God's meat.*[3] These epithets sufficiently express the aversion which the drug excites in those who are unaccustomed to its use, and the esteem it is held in by those who are more familiar with its qualities. It is uncertain whether σιλφιον of the Greeks, and *laser* of Latin authors,[4] really designate the substance under consideration; the account which they give of its uses, therefore, loses much of its interest in connection with the present subject, particularly as it adds nothing to the knowledge which later and more definite observation has furnished.[5]

When fresh, and before it has concreted, assafetida is said to have an extremely powerful smell and taste, which it loses in a great degree by age. The odor bears a striking resemblance to that of garlic, but is at the same time more fetid and aromatic; the taste is acrid and bitter, and very persistent in the fauces. In Persia it is used as a condiment, either mixed with the food or rubbed upon the vessel in which the food is contained. It is regarded as useful in correcting the flatulence to which the Orientals, as great vegetable eaters, are subject.[6] These people employ it also as an application to wounds, and believe it to possess aphrodisiac virtues. Acosta relates that it is used in the East to relieve horses of wind confined in the bowels, and also that it is thought to appease the toothache when introduced into a carious cavity.

Action. *On Animals.*—When assafetida or its volatile oil is administered to animals, and some hours afterwards they are killed, the characteristic odor of the drug has been detected in the blood of the mesenteric veins, according to some authorities. (*Flandrin.*) The reporters of the Philadelphia Academy of Medicine,[7] in some of their experiments, did not detect the characteristic odor in the serous cavities, the thoracic duct, or the blood of the carotid artery. But in another one, when the fetid solution had been thrown into

[1] MURRAY, Apparat. Med., i. 361. [2] STRUMPF, i. 756.
[3] ACOSTA, p. 281. [4] PLINY, Hist. Nat., lib. xix. cap. 3.
[5] For a full account of the historical question vid. STRUMPF, loc. sup. cit.
[6] In the repugnance which we feel at the idea of using so loathsome a substance as a condiment, we are apt to forget that garlic-eating, which is equally offensive, prevails in the most refined of Christian nations, and that half-putrid cheese and stinking game are ranked among the greatest delicacies by English epicures.
[7] Phila. Journ. of Med. and Phys. Sci., iii. 290.

the rectum of a cat, its odor was soon afterwards recognized on the animal's breath, and in the blood of the jugular vein and of the carotid artery. When a solution of the drug was injected into the abdomen of a cat, its odor was perceived in the animal's breath, in the serous and mucous cavities, and in the blood. Although a portion of these experiments furnish negative results, the remainder demonstrate that assafetida is absorbed by the blood-vessels.

On Man.—Jörg endeavored to estimate the action of assafetida, and made comparative experiments with it upon eleven persons in good health.[1] He found that distinct effects were produced by doses of a single grain, and that they often lasted for two or three days; and also that the susceptibility to be influenced by the drug varied in different persons. In doses of gr. ss to gr. xx, it gave rise to characteristic aliaceous eructations which often lasted for twenty-four hours, showing how long the medicine remained in the stomach; a burning sensation in the fauces which continued for many hours, and a swelling of the under lip, were observed in several cases; the digestion was not rendered more active, but rather impaired; there was pain, with oppression and fulness of the stomach, distension of the abdomen, a discharge of fetid gas from the bowels, frequently a strong inclination to go to stool, and sometimes thin and repeated evacuations. At the same time the head was more or less affected with flying pains, various nervous or hysterical phenomena displayed themselves, and there was a general sense of malaise. The pulse and respiration often became slower, the cutaneous and pulmonary exhalations were increased, the urine was not augmented but became more acrid and burning; the sexual desire was sometimes excited, and the menstrual period advanced. In larger doses, 10 to 30 grs., assafetida increased the secretions of the abdominal and pulmonary organs, but especially of the liver and bowels, augmenting the peristaltic action of the latter. It excited the appetite and digestion, produced discharges of intestinal flatus, improved morbid secretions of the mucous membrane, and caused the expulsion of intestinal worms. A continued use of the medicine, on the other hand, enfeebled the digestion, and still larger doses, besides colic and heat in the abdomen, produced nausea, vomiting, and diarrhœa.

After reading this detail of numerous and distinct symptoms produced by small doses of assafetida, the reader will scarcely be prepared for M. Pidoux's statement, that after taking half an ounce of good assafetida at a single dose, he was not aware of any change except that all of his secretions became horribly fetid for the space of two days.[2] Jörg could not detect the smell of assafetida in either the urine or the sweat of persons who were using it. But, it is affirmed, on the other hand, that among the Asiatics, who, as already stated, make a free and daily use of this substance, it renders

[1] Compare Jörg, Materialien, Mitscherlich, Strumpf, etc.
[2] Thérapeutique, 5ème éd., ii. 220.

the perspiration intolerably offensive. Barbier detected the smell very distinctly in the urine of a girl who was using assafetida. The characteristic odor has also been perceived by others in the secretion from ulcers, as well as in the urine of those who were taking it.

In attempting to appreciate the action of the remedy, Neumann observes: Whether it acts directly or indirectly on the nervous system is a question of trifling moment, even if it were possible to answer it. It is certain, however, he proceeds, that it invigorates the brain and muscular system, and influences the organic life of the nervous and vascular system more beneficially, perhaps, than any other medicine. Whatever part of the economy it acts upon favorably, it does so simply by increasing its normal power. While its only disagreeable influence on the stomach is to excite fetid eructations, it, on the other hand, improves the appetite, strengthens digestion, and relieves spasmodic affections of the intestines. To all the other systems, he is of opinion that it acts as a wholesome stimulant, among other things strengthening the vision and enlivening the spirits. This favorable statement, it must be remarked, is not fully borne out by general experience, which proves it to play, like other nervines, a very subordinate part in the cure of disease.

Remedial Employment. *Diseases of the Nervous System.*—It is not in purely nervous affections that assafetida has gained the greatest credit; the most that can be expected from its use is to palliate the symptoms during the paroxysms of the disease; a radical cure is to be sought for in the use of more powerful medicines. Assafetida is one of the most valuable agents that can be employed in the treatment of *hysterical* cases, because it palliates several extremely annoying symptoms, but not often because it is capable of removing the principal or radical disease. Cullen, who lauds its anti-hysteric virtues, would seem to have reference only to its action during the paroxysm, for he remarks, that when it could not be taken by the mouth, he has "found it given in glyster to be very effectual."[1] In true *epilepsy* it is perfectly useless. A case of apparent epilepsy, but probably involving hysterical elements, is reported to have been cured by this drug.[2] *Hypochondriasis* may sometimes be benefited by the direct influence of assafetida upon the nervous system, but more generally the degree of good it is capable of is due to the action of the drug upon the digestive function, which is the source and starting-point of the morbid phenomena in this disease. But of this action more specific mention will be made below. According to Neumann nothing more effectually relieves the paroxysms of *spasmodic asthma* than assafetida, and he recommends as extremely prompt and efficacious the following mixture: ℞.—Tr. fœtid. f℥iij; tr. lobeliæ, f℥j; of which forty drops are directed for a dose. Evidently the lobelia is, in this instance, the capital ingredient of the prescription, and consequently the evidence of the author cannot be allowed to weigh

[1] Mat. Med., ii. 367. [2] POLLOCK, Lancet, Aug. 1869, p. 267.

against that of Pereira, who says that he has never seen assafetida give relief in purely spasmodic asthma, or of Cullen, who states that he seldom found it of much service. Trousseau and Pidoux, however, affirm that in their hands the remedy has produced incontestably good results. Several authors speak of the efficacy of assafetida in *neuralgia*, but there is no proof of its possessing even a palliative influence over this affection, except indirectly, or by improving the vigor of the digestive apparatus, and diminishing the susceptibility to external impressions, which is so frequently the immediate cause of neuralgic paroxysms. But, even in this respect, the medicine is very much inferior to those which influence more directly and powerfully the source of the disease.

Diseases of the Respiratory Organs.—In *chronic catarrh*, with or without spasmodic dyspnœa, assafetida is frequently of marked advantage. Cullen regarded it as more useful in such cases than the other fetid gums, and Neumann states that he found it, in combination with oxymel of squills, perhaps the most efficient remedy that he employed. When the wheezing is considerable, and the expectoration is rendered difficult by general debility, or when the cough is spasmodic, much benefit may be derived from this medicine. Such a combination of symptoms occurs frequently among persons advanced in life. Miller, Kopp, and others have vaunted the efficacy of assafetida in *whooping-cough*. The last-named writer affirms, also, that children have less repugnance to it than to some other medicines which seem less nauseous, so that they readily become used to it, and even grow fond of its taste when it is combined with mucilage and sugar.[1] It has also been recommended to administer it by enema in the evening to prevent, or at least moderate, the paroxysms which destroy the rest and exhaust the strength of the little patients. But in a disease of such long duration, an occasional resort to this method is all that can be recommended. Dr. Chapman speaks favorably of the medicine, but agrees with the best authorities in delaying its use until the febrile stage, if any, shall have passed by.[2] Aberle esteemed it highly under similar circumstances, and more recently Ancelin reports his successful use of it by enema.[3]

Diseases of the Digestive Organs.—In that torpid condition of the bowels which is so commonly associated with general debility, when digestion is imperfectly accomplished, and severe attacks of colic supervene; when tympanitis, sometimes of an immoderate degree, oppresses the breathing, and becomes the immediate exciting cause of an hysterical attack: when at the same time there are some signs of chlorosis, or this disease is fully developed, a combination of symptoms is presented, of very frequent occurrence among females, and particularly those of a highly nervous temperament, a combination which is the cause of extreme suffering to the patient, and often proves a great annoyance to the physician. No single

[1] Archives Gén. de Méd., xvi. 289.
[2] Thérapeutics, ii. 266.
[3] Bull. de Thérap., li. 283.

medicine is more useful than assafetida in removing this complicated assemblage of symptoms, acting as it does upon the digestive organs to overcome constipation, expel flatus, and improve the tone of the stomach, and in this way relieving the nervous system from an irritation which constantly tends to throw it into disorder, while it gives tone directly to this system, and renders it less susceptible to morbid impressions from within and from without. Indeed, the principal utility of the drug is displayed in cases of this very description; the other affections in which it has been recommended might be nearly, if not altogether, as well treated without its aid, but the combination of symptoms just described is relieved with equal promptness and certainty by no other agent. Its efficacy is much increased by modifying the mode of its exhibition according to the symptoms of the individual case. Thus, when, as they have been above detailed, they occur in persons of an anæmic or chlorotic constitution, the assafetida should be associated with aloes and iron, and taken soon after, or immediately before meals. But when a flatulent and hysterical attack has already commenced, there is but one efficient method of employing the drug, which is by administering a large enema of the milk of assafetida. It usually operates without delay, producing profuse and repeated discharges of flatus. If there is reason to suppose that undigested food remains in the lower bowels, a stimulant purgative containing assafetida ought also to be prescribed.

In various other diseases assafetida has been reputed to be useful. Many cases might be referred to in which it appeared to aid in the destruction and expulsion of *worms*, but it is much inferior to numerous vermifuge medicines. A mixture containing aloes and assafetida is reputed to form an efficient enema for the destruction of ascarides of the rectum. In *caries* of the bones, it is thought to be useful by several writers, one of whom, Neumann, speaks of its utility as "generally admitted." The proofs of this statement are difficult to be procured. The author just quoted, and several others, advocate the use of assafetida in *typhus* and *puerperal* fevers; but except to meet one incident of the latter affection, there is no satisfactory ground for the favorable opinion he expresses. The symptom alluded to is tympanites, which occasionally is so extreme as to impede respiration seriously, and probably, also, to interfere with the action of the heart. Nothing can be more appropriate than fetid enemata to mitigate the suffering and lessen the danger which this state involves.

After *nervous apoplexy*, or that form which seems to consist in simple congestion of the brain, of such violence, however, as to produce more or less paralysis, the latter symptom may continue for some time after the attack, and gradually diminish until it completely disappears. A gently stimulating treatment addressed to the nervous system hastens the cure. Among the remedies for this condition, assafetida deserves a prominent place; for its property of imparting vigor without exciting, renders it appropriate. It has also been recommended as a cure for *chorea*, especially when

the disease occurs about the age of puberty in females. The establishment of the menstrual function frequently cures spasmodic affections, and the emmenagogue properties of assafetida may therefore become the indirect means of its removing the nervous disorder. Under other circumstances, its power over chorea may be regarded as almost null.

Administration and Dose.—Assafetida plaster is sometimes applied to the abdomen to relieve habitual flatulence, and to the back of the chest in whooping-cough. It has also been said to prevent the development of caries of the vertebræ, but the symptoms mistaken for that disease were probably those of spinal neuralgia.

As a clyster, for ordinary purposes, a simple mixture by trituration of assafetida with hot water suffices, or the addition of tincture of assafetida to warm water in the proportion of one ounce to eight. It is, perhaps, the most useful of all the modes of administering the drug.

Assafetida mixture is the most prompt and decided in its action of all the forms of administering assafetida by the mouth, but its taste renders it objectionable. *Dose:* one or two tablespoonfuls frequently repeated.

The various simple and compound pills into which assafetida enters are best suited to those habitual states of flatulence in nervous and feeble subjects which are so common in this class of patients. The best formulæ are those which combine with this drug a laxative and a tonic, such as *pil. aloes et assafœtidæ*, and the *pil. galbani compositæ*.

The drug is seldom prescribed alone, but in powder or pill its dose is from 5 to 15 grains. The tincture of assafetida may be occasionally given in the dose of a fluidrachm, but owing to the alcohol contained in it, it does not answer for habitual use.

DRACONTIUM.—Dracontium.

Description.—*Symplocarpus fœtidus*, *Ictodes fœtidus*, or *Dracontium fœtidum*, is an indigenous plant, growing in low and moist situations. It has very large, smooth, and fleshy leaves, ovate or heart-shaped, with greenish bracts. The flower-sheath is hood-shaped, and marked with purple spots. The flowers are numerous and small, and are closely set upon a rounded and elongated spadix. The root, which is the officinal portion, is a large tuber, with numerous fleshy fibres. The whole plant exhales an acrid, rank, and nauseous smell, which has obtained for it the name *skunk-cabbage*, *polecat-weed*, etc. It has a very acrid taste. These qualities are partially dissipated by drying; but, if the operation is carefully conducted, the root retains a portion, at least, of its virtues.

Action and Uses.—Dr. Bigelow states that in small doses this plant is stimulant and antispasmodic, and in large ones narcotic, and that thirty grains of the powdered root, if freshly prepared,

will bring on vertigo, nausea, and frequently vomiting.[1] Locally, it acts as an irritant.

Its medicinal power was first indicated by Schoepf as being expectorant, stimulating, and incitive (incidens), and the Rev. Dr. Cutler, of Massachusetts, drew attention to its virtues in *spasmodic asthma* by describing its effects upon this disease in his own person. He employed the powdered root in doses of from thirty to fifty grains during the paroxysms. Dr. Bigelow states that in certain forms of asthma, and in *chronic catarrh*, it succeeded, even when the disease had previously been of great obstinacy; and Eberle says that in chronic cough, attended with a cold, phlegmatic habit of body, he employed it with the most decided benefit. Dr. Thatcher, and also Dr. Heintzelman, state it to be useful in the spasmodic stage of *whooping-cough*. In *hysteria*, *spasmodic pains*, in "spasmodic affections of the abdominal muscles during parturition or after delivery" (*Thatcher*), in *chronic rheumatism*, and also in "*dropsy*," it has been recommended. It may therefore be used when its quality is good; but several other medicines are more to be depended upon.

From ten to twenty grains of the recently-dried root may be given at a dose. An infusion made by displacement, with an ounce of the root to a pint of cold water, may be prescribed in the dose of one or two tablespoonfuls. A saturated tincture may be prepared in the same manner, and administered in the dose of one or two teaspoonfuls.

SUCCINUM.—Amber.

Description.—Amber is supposed to be the fossil resinous product of some extinct species of conifera, an opinion based upon the microscopic examination of the vegetable fragments contained in it. Other views of its nature and origin have been proposed by various naturalists, who have pronounced it to be concrete petroleum, hardened honey, oil of turpentine solidified by an acid, a product of the decomposition of wax, and various other things altogether fanciful.[2] Amber is found chiefly upon the borders of the Baltic Sea, and in the North of Asia. It occurs in yellow or reddish translucent masses, which are brittle, and have a resinous fracture. When rubbed briskly, it becomes negatively electric; and at the same time, or, still better, when powdered and thrown upon coals, it emits a grateful and aromatic fragrance. It has no decided taste. It is soluble in strong alkaline fluids, and somewhat less so in ether. Two preparations of amber have been used in medicine, viz., *succinic acid* and *rectified oil of amber* (Oleum Succini). The latter is obtained by the dry distillation of amber. When freshly prepared, it is a yellowish transparent liquid, with a pungent and peculiar odor, and a hot, acrid taste. In composition it is a hydrocarbon, but it is oxidized by exposure to the air, and becomes

[1] Mat. Med., p. 167.
[2] For a learned history of this substance consult Strumpf, Handbuch, etc., i. 787.

dark and thick. Succinic acid is obtained from amber by sublimation. When purified, it forms white crystals, of acid qualities, soluble in cold but more readily in hot water, and in alcohol.

Action and Uses.—The fumes arising from amber thrown upon burning coals are apt to provoke coughing. *Succinic acid* is said to raise the pulse, promote diaphoresis and the secretions of the lungs, and to augment the activity of the nervous centres.—*Oil of amber* is a powerful irritant of the skin. When taken internally, it is reputed to be antispasmodic and stimulant. The first-named preparation was once employed in mucous profluvia of the lungs and urinary organs, much in the same manner as the terebinthinates continue to be used. In debility of the nervous system, and in spasmodic diseases, it was also reputed to be efficacious. Some fanciful persons have even imagined that strings of amber-beads around the neck or limbs control convulsive diseases of an hysterical type.[1] Oil of amber is, with more probability, reported to be useful in *retrocedent gout* and *rheumatism*. It has also been given internally for the same affections, but more especially in *eruptive diseases*, *epilepsy*, *hysteria*, *whooping-cough*,[2] and *amenorrhœa*. Externally it is employed as an addition to stimulating liniments for *rheumatism* and *paralysis*, and as a rubefacient application to the spine in convulsive disorders, especially those of children. It has also been used successfully as a lotion for *hæmorrhoidal tumors*, which it dissipates by an irritant operation. The fumes of amber thrown on live coals are sometimes used, or raw cotton impregnated with them is applied to the affected parts, in the first-named diseases. Powders and pastilles intended to correct foul smells by fumigation generally contain amber.

The *dose* of succinic acid is from five to fifteen grains, and of the oil of amber from ten to fifteen drops.

VALERIANA.—VALERIAN.

Description.—The root of *Valeriana officinalis*. This plant is a native of Europe, and belongs to the family of Valerianaceæ, a name said to be derived from the Latin *valere*, and intended to express the wholesome properties attributed to the plant. The *nard* or *spikenard* of antiquity, so renowned among the aromatics of the East, was a preparation of valerian, *V. Celtica*. Valerian grows through Europe, and in every variety of soil, but is said to have a stronger smell and taste when produced in dry and elevated than in low and moist situations. Its most important constituents are—an *essential oil* and *valerianic acid*.

ACIDUM VALERIANICUM.—*Valerianic Acid*.

This acid is obtained by decomposing valerianate of soda with

[1] Revue Médicale, lxxxv. 84.

[2] DANET claims for amber and its derivatives an almost specific virtue in teething colic, infantile convulsions, and whooping-cough (Bull. de l'Acad. de Méd., xxviii. 521.)

sulphuric acid and distilling the resulting oily acid liquid. It is a colorless liquid of an oily consistence, a penetrating disagreeable odor, and caustic taste. Its specific gravity is 0.935. It is soluble in thirty parts of cold water, and mixes in all proportions with alcohol and ether.

AMMONII VALERIANAS.— *Valerianate of Ammonium.*

It is prepared by passing gaseous ammonia through valerianic acid. It is a white crystalline salt having the odor of valerianic acid and a sharp sweetish taste. It deliquesces in moist and effloresces in dry air. Dose, one to three grains.

EXTRACTUM VALERIANÆ FLUIDUM.—*Fluid Extract of Valerian.*

This extract is made by displacement with alcohol. It is the best form in which valerian can be exhibited for ordinary purposes. The dose is one or two fluidrachms.

INFUSUM VALERIANÆ.—*Infusion of Valerian.*

Half a troyounce of valerian is macerated in a pint of boiling water for two hours in a covered vessel, and then the liquid is strained. It may also be made by percolation. The dose of this infusion is a wineglassful.

OLEUM VALERIANÆ.—*Oil of Valerian.*

It is obtained from valerian-root by distillation, and, when fresh, is of a pale-green color, and has the pungent aromatic taste and smell of valerian in a high degree. It grows brown and thick with age, and becomes resinous by attracting oxygen from the air. It is the most powerful preparation of valerian, and may be administered in the dose of four or five drops, suspended in sweetened water. It is soluble in alcohol and ether.

TINCTURA VALERIANÆ.—*Tincture of Valerian.*

This preparation is made by percolation from four troyounces of valerian so as to obtain two pints of tincture. Its dose is stated to be from one to four fluidrachms, but the proportion of alcohol in either quantity is too great to warrant its repeated administration.

TINCTURA VALERIANÆ AMMONIATA.—*Ammoniated Tincture of Valerian.*

This preparation is made by macerating four troyounces of valerian in two pints of aromatic spirit of ammonia for seven days, and filtering the solution. Its peculiar antispasmodic virtues are equally well exhibited by an extemporaneous mixture of the aromatic spirit of ammonia and the fluid extract of valerian. Its dose is one or two fluidrachms.

Several non-officinal solutions or elixirs of valerianate of ammonia are in common use. That made according to Dr. Goddard's formula is the most agreeable. Dose, one fluidrachm. Valerianates of quinia, morphia, zinc, etc., will be noticed under their appropriate titles.

History.—Valerian seems to have been used as a medicine from an early period. All the ancients describe it as being diuretic and

emmenagogue.[1] Galen affirms that by its means he cured adults and children of epilepsy. Fabius Columella vaunted its anti-epileptic virtues, which are also maintained by Alston.[2] Hoffmann regarded its diuretic properties, at least, as unquestionable. Externally, says Schroder, it strengthens vision, removes opacities of the cornea, allays headache, promotes the menses; in baths, it excites perspiration; inhaled, it dries up catarrhs; it tempers the malignity of carbuncles, cleanses foul ulcers, etc. One of the most singular properties of the plant is its effect upon cats, which Matthiolus describes in these terms: "Cats are so fond of valerian that they smell it at a great distance, and purr with delight while they are eating it." A modern author[3] paints a still more vivid picture of this singular phenomenon. "In places where valerian is stored," he remarks, "cats may be seen rolling themselves upon it, mewing and purring in the most extraordinary manner, then attacked with spasms and convulsions, and at last expiring in a perfectly voluptuous frenzy." Pringle and Dresky supposed, from their experiments, that valerian had antiseptic properties, the one finding it superior to salt, and the other to cinchona, in this respect.[4] Both were probably mistaken.

Action.—The only phenomena excited in the lower animals by valerian have just been described. It acts upon man, in health, as an excitant, but not powerfully. Its powder, applied to the nostrils, produces sneezing, and may be conveniently used as a sternutatory. When taken habitually, and in moderate doses, it augments the appetite and the activity of digestion, without restraining the action of the bowels. Two drachms at a single dose generally occasion a sense of heat and weight in the abdomen, eructations, and frequently vomiting, colic, and diarrhœa; and, along with these symptoms, some excitement of the circulation, augmented warmth of the whole body, and either perspiration or an increased flow of urine. The first effects of valerian upon the nervous system, in doses of from one to two drachms, are to render the mind tranquil, to incline to good humor, and dispose to exertion; but these results are usually accompanied with a lively formication in the hands and feet, and a sensation about the head and spine which has been compared to the aura epileptica. Sometimes there is a sense of embarrassment in the head, with heaviness, or even pain.[5] The action upon the circulation is chiefly shown in those of its morbid states in which the pulse becomes frequent and feeble, denoting the exhaustion which succeeds an over-excited state of the nervous system; under these circumstances it renders the pulse less frequent, and at the same time stronger. Barbier mentions the following phenomena as exhibited by a patient in the Hôtel Dieu of Amiens. When about falling asleep, he suddenly started up, believing that he saw a great light, and that the side of the ward opposite to him was in

[1] ADAMS, Comment. on Paul. Ægineta, iii. 396.
[2] Mat. Med., i. 535.
[3] FOY, Mat. Med., i. 428.
[4] Appârat. Med., i. 275.
[5] See MITSCHERLICH, STRUMPF, op. cit.; and JOERG, Archives Gén., xxv. 402.

flames. Other patients imagined that flashes of fire were darting from their eyes. But such phenomena would appear to be exceptional.[1] The largest dose of extract of valerian, and its most striking alleged effects, are those recorded by Dr. Abell,[2] in a case of supposed poisoning by it. Within a period of eight hours a man of nervous temperament took two drachms of extract of valerian. He became delirious, threatening and vociferating violently. His pulse was frequent, tremulous, and irregular, and the pupils extremely and fixedly dilated. He was blind, recognized no one, imagined himself beset by dangers, and staggered in walking. He had also a constant desire to urinate. Under the influence of a grain and a half of sulphate of morphia the pupils contracted, sleep ensued, and in two hours he was awakened without difficulty and in a perfectly rational state of mind. The symptoms here detailed are so evidently those of poisoning by belladonna or stramonium that we must presume the extract of one of these substances to have been taken by mistake.

Joerg thinks that when given in very moderate, yet operative, doses, the action of valerian lasts for three or four hours, or in large quantities from eight to twelve hours, and that its influence is more lasting on the brain than on the bowels. In all of the instances now referred to, the doses employed were greatly larger than it is usual to administer in disease; yet it would not be just to infer that the smaller quantities are inoperative. A dose of four or five grains of sulphate of quinia produces trifling symptoms, if any, in the healthy subject; uva ursi, in large doses, occasions no distinct phenomena; even the common articles of food and drink give rise to no specific effects; yet it cannot be said that they do not powerfully modify the vital state. The virtues, then, of valerian are to be sought for under conditions of the system which are adapted to bring its effects into strong relief, states in which the susceptibility to the medicine is morbidly increased, and in which, therefore, it may be presumed that its curative power is enhanced. The experiments of Reissner upon rabbits, with large doses of valerianic acid (ʒj to ℥iij), proved it to be a local irritant, and capable of destroying life. In smaller doses the symptoms were marked, but not peculiar, consisting chiefly of quickened, and then of languid, breathing and pulse, with debility or loss of power in the limbs.[3]

Remedial Employment.—Valerian is a prominent medicine among those called nervines, and is in fact used almost exclusively in the treatment of functional disorders of the nervous system. Although most frequently prescribed as a palliative of the more urgent symptoms of several among these affections, it has nevertheless a well-supported claim to a more important position, as the following statement will show.

Epilepsy.—In the historical sketch given above, it was seen that among the earliest of its recorded uses valerian was prescribed as a

[1] Op. cit., ii. 153. [2] Boston Med. and Surg. Journ., March, 1856, p. 117.
[3] REIL, Pflanzenstoffe, p. 64.

remedy for epilepsy. At various epochs down to the present time, it has enjoyed a reputation for curing this malady, but without attaining an uncontested right to the title of an anti-epileptic, a lot which indeed it shares with every medicine which has been distinguished by this name. The doubts which obscure the virtues attributed to all medicines are magnified in the case of such as are used in the treatment of nervous affections. The irregularity of the phenomena presented by them, their protean changes, their dependence upon accidental circumstances, the close relation in which they stand to the mental and moral conditions of the patient, render it extremely difficult to distinguish these affections from one another, and those among them of an organic from those of a functional origin. A mature and experienced judgment, guided by all the light which science has shed upon this obscure subject, is the only, though by no means an infallible, safeguard against falling into error. Such circumstances render the task a very difficult one to arrive at a just valuation of the testimony recorded in favor of valerian as a remedy for epilepsy, for it is certain that not a few writers have been imposed upon by the epileptiform convulsions which occur in hysteria and those which frequently arise from temporary disturbance of the excito-motory function, by intestinal worms, and other local and mechanical causes. Nothing can better illustrate the obscurity of this subject and the difficulty of distinguishing epilepsy from less serious convulsive affections, than the unsuccessful attempts which have been made to found such a distinction upon the essential nature of the analogous affections. Thus, when it is said that "the term epilepsy presents to the mind the idea of an essential morbid modification of the cerebro-spinal innervation, a serious, profound, chronic, and obstinate modification, which sooner or later ends by impressing upon the functions, which it at first disturbs at intervals, alterations of a permanent character which annihilate all the functions of the nervous system of animal life,"[1] we have an hypothesis and a description combined, a formula which does not add a single idea to our previous knowledge, nor offer us any assistance in recognizing examples of the disease. The only means by which the error of confounding epileptic and epileptiform convulsions can be avoided, is to compare diligently, and one after another, the symptoms presented in each case with those derived from model examples, after which the truth will generally appear. Thus, omitting the consideration of *epilepsia minor* or *petit mal*, the essential phenomena of the epileptic convulsion are the following: it either occurs without warning, or if any, it is in the form of the *aura epileptica*; the loss of consciousness and sensibility is sudden and complete; the convulsions are clonic, and they are more violent on one side than on the other; the face is purplish or livid, and there is froth upon the lips; after the fit there is at first stupor, then excitement; finally the mind grows feeble when the disease has continued long.

[1] PIDOUX.

Now if these diagnostic marks could be applied to the cases of presumed epilepsy said to have been cured by valerian, the truth would be much more accessible than it actually is, for in nearly all the instances, and especially in those recorded by the older writers, the symptoms are very imperfectly described, or, as more frequently happens, their details are quite omitted. Occasionally, however, an illustration of the remark just made presents itself, as in "a case of epilepsy of twelve years' duration cured by valerian."[1] The author asserts that "the symptoms which attended the paroxysms were indubitably those of epilepsy," yet the paroxysms were preceded by a sensation of *globus* in the throat. The case ceases at once, therefore, to illustrate the virtues of valerian as a remedy for epilepsy. The other symptoms might be of doubtful significance, but the *globus hystericus* is a pathognomonic sign of hysteria. It is to be suspected that many other cases, said to be of epilepsy and cured by valerian, would as little sustain a critical scrutiny as the one just referred to; there are not a few, however, in which the anti-epileptic virtues of the medicine are placed beyond cavil, and these will be pointed out in the next paragraph.

The use of valerian in the treatment of epilepsy was, as has been already stated, of very ancient origin; its revival is due to Fabius Columella, who published a treatise setting forth its having cured him of this malady when all other means had failed; but he is said to have subsequently relapsed.[2] Wepfer relates that he rescued from this disease several girls and boys by the long-continued use of simple valerian root, and among them a girl under the age of puberty who suffered not less than fifteen paroxysms in the course of twenty-four hours.[3] Much of the vogue enjoyed by valerian as a remedy for epilepsy is ascribed to its recommendation by Tissot. This author indeed declares his persuasion that when valerian fails to cure it is because the disease is incurable; but nearly all of the support that he offers for this opinion is a number of cases compiled from previous and contemporary writers, although he asserts that he had cured by its means a "large number" of idiopathic epilepsies.[4] But as he speaks of "epilepsy and nervous affections which require strengthening nervine remedies," it is probable that he did not distinguish very clearly the former from the latter diseases. Enough remains, however, after all of these deductions from Tissot's evidence, to prove that in his hands valerian did sometimes really cure epilepsy, and the proof is corroborated by later testimony. J. Frank says that, although able to present only one cure for ten failures, he still regards the powder of valerian given in large doses, and long continued, as occupying the first rank among vegetable anti-epileptic remedies.[5] Guibert found that where it did not cure the disease, it still moderated the violence of the

[1] Edinb. Med. and Surg. Journ., xxx. 297.
[2] MURRAY, i. 275. [3] De Affect. Capitis., Obs. cxxv.
[4] Malad. des Nerfs, chap. vii. art. xxv.
[5] Malad. du Syst. Nerveux, chap. xxxviii. art. vii.

spasms and rendered them less frequent.[1] Vogt calls attention to the circumstance that nearly all popular nostrums for epilepsy contain valerian, and Richter instances several of this sort.[2] In 1838, M. Ferrus made a report to the French Academy of Medicine on a memoir of M. D'Huc, in which the author relates seven cases, of which six were recent and the remaining one of seven years' standing. Valerian was administered in decoction and extract, and of the latter the daily dose was from one to two drachms. Under its use, the paroxysms declined in frequency and severity, and ceased after a period of from five weeks to three months. In all of the cases except one the cure appears to have been permanent. Other patients treated subsequently by M. D'Huc presented less satisfactory results.[3] Richter relates several cases of cure in his own practice by means of such combinations as are referred to in the foot note. Dr. Copland, from his own experience, speaks favorably of valerian, provided that it be appropriately administered, and that depletion and evacuations have been premised in plethoric cases.[4] On the whole, there can be no doubt that valerian has sometimes cured genuine epilepsy, and that it is most successful in young patients, and when the disease is of recent origin. In the case of children it must not, however, be forgotten that the remedy is an efficient anthelmintic, and that it very probably has sometimes cured the spasmodic affection by destroying the worms upon which the attacks depended. In other cases, where the convulsions have originated in fright, suppressed emotion, or in a simple susceptibility of the nervous system to more ordinary impressions, the efficacy of the remedy is still more unequivocal. But even here it must be given in large doses and perseveringly continued, while other agencies adapted to improve the tone of the nervous system, strengthen the digestive powers, and withdraw injurious excitants, should be prescribed in conjunction with it.

Hysteria and other Nervous Disorders.—In fully developed hysteria, and especially in that form of the affection which occurs in plethoric and otherwise robust females, it is doubtful whether valerian is a remedy of much value. As a palliative, it may be usefully employed to avert paroxysms which some accidental excitement would have provoked, or even to mitigate them when they cannot be averted. It is more useful if the disease attacks females of a weak constitution and excitable temperament, with imperfect digestion, and enfeebled by care and anxiety, and when a tonic as well as an antispasmodic treatment is called for. In such cases it not only is efficient in mitigating the individual attacks, but it will sometimes contribute materially to the complete cure of the disease. The cases alluded to approach most nearly to that un-

[1] Revue Méd., xxviii. 380.

[2] Ausfürliche Arzneimittellehre, iii. 26. The same author presents the formulæ of several nostrums employed successfully for this disease. They all contain oil of cajeput, and some of them pomegranate, *e. g.*: ℞.—Valerian, ℈ij; pomegranate leaves, ℈ss; oil of cajeput, 4 drops. Given three times a day

[3] Bull. de l'Acad. de Méd., ii. 759.

[4] Dict. of Medicine, art. Epilepsy.

defined disorder of the nervous system which is described in the next paragraph.

This disorder may be described as *hysterical*, rather than as being in itself *hysteria*. It seldom occurs among females who lead an active and laborious life, or among the rural population. Most frequently its subjects are met with in large cities, or wherever habits of luxurious living prevail, where the senses are stimulated to excess, and the imagination is overstrained by exciting scenes, conversation, and books, and by occupations which the artificial wants of civilization create. It consists, at first, in a morbid sensibility to external impressions; the patient at last seems to suffer, in the absence of any outward cause, all of the pains which external excitants are capable of producing, or appears to have the faculty of transforming into real sensations the suggestions of a disordered fancy. It is a state familiarly known as the *vapors*, and is a form of hypochondriasis. Tissot and Trotter have described its varying phenomena very accurately, and Trousseau and Pidoux present the following abstract of them: One patient complains of oppression, of stricture of the throat or temples, or palpitation of the heart; another of throbbing of the temples, and noises in the ears, a sensation like the commencement of a cold in the head, local shudderings, and flushes of heat in the face; another is unable to remain quiet in the same spot, and has what is so expressively termed the *fidgets*, with gaping, yawning, and hiccup; or the same phenomena may be somewhat modified, and the patient find no comfort except in active, and even in fatiguing exercise; others, again, complain of a difficulty of swallowing, of borborygmi, eructations, and burning sensations in the abdomen, with flatulent distension coming on suddenly and as suddenly subsiding, præcordial distress, causeless alarms, morbid susceptibility, etc. All of these symptoms are completely under the control of valerian. One or more doses of it will dispel, as with a charmed power, the unnatural disorder of the functions, and restore calmness and equanimity to a patient in the midst of torments none the less harassing because they do not threaten life. And although this medicine is not sufficient of itself to eradicate the disorder, it yet so promptly and effectually removes the most prominent and distressing symptoms, as to place the patient in a condition the most favorable for profiting by measures directed against the morbid state from which the nervous derangement springs.

Several cases are related by Latour[1] which offer a somewhat modified aspect of the same disease. One of his patients was a lady whose general health was perfect, and in whose circumstances there was nothing to explain the symptoms which she exhibited. Whenever she sat down to meals she grew pale, and experienced a suffocating constriction of the chest, followed by hurried and laborious inspirations and frequent gaping. These symptoms lasted for ten or twelve minutes at first, but were prolonged by the displeasure

[1] Bull. de Thérap., xx. 343.

which they caused the lady's husband, who took them to be voluntary. During a year various methods of treatment were employed, cold and sea bathing, bismuth, quinine, but all in vain, and the symptoms were at last removed by powdered valerian, in the dose of a drachm, taken daily before dinner. Within a fortnight the attacks ceased, and were not renewed. Oil of valerian dissolved in ether may be administered by inhalation in all cases requiring a prompt impression by the drug, and especially during hysterical attacks.

Hysteria sometimes assumes the mask of some familiar disease, or is superadded to a definite derangement of the health. Hysterical headache is one of the most common forms of attack. For this troublesome affection an application of dry valerian to the forehead and temples is strongly recommended by Richter. The same author praises the medicine in those spasmodic attacks which follow loss of blood, and especially profuse and painful menstruation, as well as those which accompany an impoverished state of the system in chlorosis, leucorrhœa, scrofula, etc. M. Déclat has published an account of the efficacy of *valerianate of ammonia* in a case of facial *neuralgia*, which had for years resisted every other known treatment, both local and general.[1] It is certainly one of the best palliatives for moderately severe attacks of this disease. In *gout* the fever is often a consequence of an irritable rather than of an inflammatory state, and is beneficially influenced by valerian, which calms the tumult of the system and gives the patient ease. When this affection attacks the stomach with spasmodic rather than inflammatory symptoms, the same remedy is applicable, and the oil is the most efficient form for its exhibition. *Cramp in the stomach* is readily relieved by the same means, and that morbid sensibility of the organ which is a frequent cause of chronic vomiting. A mixture of one part of the tincture of valerian with two of the compound spirit of lavender has been successfully employed for this affection, in the dose of thirty or forty drops three times a day. Enemata of the infusion of valerian are recommended in *chronic dysentery* accompanied with tormina and tenesmus. Valerian is useful in calming the *palpitation of the heart* which so frequently accompanies dyspepsia. It also moderates the paroxysms of *whooping-cough*, and is most distinctly useful during the decline of the disease.

Valerian is deserving of a trial in *mental derangement* produced by sorrow and anxiety, homesickness, disappointment, the puerperal state, etc., before the disease has become rooted, and the patient possessed with a fixed idea. It is also recommended in *nervous atony* simulating paralysis, a state in which the symptoms of apoplexy are sometimes met with, while the features are pale, cold, and sunken, the pulse small, slow, and infrequent, and the attack ends with a copious discharge of limpid urine.[2] This medicine is also valuable in another condition, which is frequently mistaken for fever, and mischievously treated by debilitating means. The

[1] Brit. and For. Med.-Chir. Rev., Jan. 1857, p. 261. [2] RICHTER, loc. cit.

patient is troubled with a sense of *fulness in the head*, a full, hard, and frequent pulse, and, in the after part of the day, congestion of the face, headache, burning of the palms of the hands, and perhaps neuralgic pains. Valerian seldom fails to mitigate these symptoms, and sometimes relieves them entirely, but more commonly it paves the way for medicines of more radically curative powers. In other cases of essentially the same nature the patient is subject to *vertigo*, accompanied with palpitations of the heart. The blood seems to rush suddenly into the head, and as suddenly to leave it and fall back upon the heart. The combination of symptoms now described is not an infrequent accompaniment of the menopause, and even of the first establishment of the menses, and although it then is, partially at least, dependent upon plethora, the necessity of depletion can generally be avoided by the administration of valerian.

This medicine is a valuable adjuvant in the treatment of *delirium tremens*, and is often sufficient to control the symptoms in those slighter cases which arise in consequence of the shock of unimportant surgical injuries. It is frequently serviceable also in *nervous headache* produced either by mental or physical causes.

St. Vitus' dance is in many cases successfully treated by valerian. Several examples of the sort are recorded by Murray, but in most of them it would seem that iron, Dippel's animal oil, or some other medicine was associated with it.

Inflammations and fevers of a nervous type are reported, especially by German authorities, to be favorably influenced by valerian. Neumann states, as conditions for its use, the absence of enteric inflammation, and an uneasiness which impels the patient to change his posture every moment, and when there is either delirium, or the mind is so excited as to be in a state of constant tension. This author ascribes to valerian a quality analogous to that belonging to opium, a power, namely, of moderating the excitement of the vascular and muscular systems growing out of excessive and irregular nervous action.[1] The same indication is regarded by Richter, after Jörg, as debility combined with morbid sensibility, and he describes it as follows: the pulse is small, unequal, and jerking; the movements uncertain; the tongue trembles when protruded; there is quiet delirium, and some insensibility; a cool, pale, dry, and inactive skin; incomplete and rapid respiration, with sighing; injected and dull eyes; limpid urine; restlessness, sleeplessness, anxiety, etc. Valerian is regarded as all the more valuable here, because there are hardly any contraindications to its use; and it is confidently recommended even during inflammation of internal organs, gastric disturbance, bilious, mucous, and putrid states of the economy, profluvia, exanthems, etc. It is also especially commended in simple catarrhal and rheumatic affections occurring in persons of an excitable temperament and predisposed to nervous attacks, and in all fevers in which the peculiarities of this tempera-

[1] Heilmittel., p. 570.

ment predominate. In most of the above cases it may be combined with stimulants and other antispasmodics, as well as with tonics, and especially with cinchona.

Indications very similar to the above, but furnished by a somewhat different pathological condition, are set forth by Pidoux. They are presented by those inflammatory and other affections in which depletion has been carried to excess, and consist of certain nervous symptoms which interfere with convalescence. Thus, sometimes, in the decline of pneumonia and typhoid fever, when ataxic and adynamic phenomena supervene in consequence of profuse hemorrhage from the nose or bowels, and the abdomen continues tympanitic but indolent—when, in a word, debility and excitability prolong one another—great benefit is to be derived from valerian. The same indication sometimes presents itself in the course of *eruptive fevers*, in consequence either of the repercussion of the eruption, or of some other accidental cause giving to the symptoms a typhoid or malignant type.[1] These general statements have received confirmation from the experience of Dr. J. Leasure, of Pennsylvania, in the treatment of *typhoid fever* with *oil of valerian*. He at first used it in cases of extreme prostration and exhaustion, when alcoholic stimuli were either rejected or proved ineffectual, and afterwards in earlier stages of the disease. It usually provoked diaphoresis, and at the same time diminished the diarrhœa. In two cases complicated with delirium tremens the symptoms of this affection were evidently under the control of the remedy.[2]

As a *vermifuge* valerian is deserving of some credit, although it is doubtful how far it acts specifically in destroying intestinal worms. It is more certainly useful in counteracting the weakness of the bowels which these parasites produce. A somewhat celebrated vermifuge of Störck is composed as follows: ℞.—Sulph. potassæ c. sulphure, jalapæ, valerianæ, āā ʒj; oxymel, scillit. ℥iv. Dose for an adult, ℥ss four times a day.

Administration and Dose.—Valerian may be administered in *powder*, in doses of from thirty to ninety grains, repeated three or four times a day. Its disagreeable taste may be somewhat disguised by the addition of a few grains of mace. The *infusion* is prepared with from 60 to 120 grains of the root in half a pint of water, to be taken in twenty-four hours. An *extract* prepared by displacement may be prescribed in doses of from ten to forty grains. The *fluid extract* is to be preferred. Its dose is from one to three fluidrachms. The *tincture*, owing to the quantity of alcohol contained in a dose, is not an eligible form of this medicine. The ammoniated is preferable to the simple tincture. The *oil* of valerian is a favorite form of the medicine in German practice, and is more decidedly antispasmodic and stimulant than the other preparations. It may be prescribed in the dose of from four to six drops mixed with sugar, or dissolved in ether or sweetened acids, and is

[1] Mat. Med. and Thérap., ii. 178.
[2] Am. Journ. of Med. Sci., April, 1855, p. 370.

perhaps, after the fluid extract, the most eligible form of the medicine for temporary uses. The infusion is applicable to the greatest number of cases. The powder is said to be preferable in cases of epileptiform convulsions, and for worms.

CASTOREUM.—Castor.

Description.—Castor is a concrete glandular secretion contained in a pair of sacs on either side of the space between the anus and prepuce or vulva of the beaver (*Castor fiber.*) It is regarded as a sort of smegma intended to lubricate the adjacent organs. It is more abundant in the male than in the female animal. In the fresh state, castor is soft and unctuous, but not fatty, to the feel, and it grows waxy by keeping; its color is brownish-yellow, and it has a strong musky or hircine smell. The castor of commerce is of two sorts, the Russian and the American, the former of which is by far the most powerful, and commands more than thirteen times the price of the latter.

History.—The ancients imagined the castor sacs to be testicles.[1] In the Hippocratic writings castor is prescribed with pomegranate juice for chronic vomiting, and its odor is recommended for hysterical affections, and especially for hysterical headache. It was prescribed with Chian wine for suppression of the menses and difficult parturition, and was employed in nearly every description of spasmodic disorder.[2] The use of castor in hysteria is mentioned by Herodotus. Dioscorides adds to this account that it is administered in clysters to arouse persons in lethargy, particularly when mixed with vinegar and rose oil.[3] Pliny quotes Sextius against the notion that the beaver, when pursued, bites off its testicles, and he even appears to distinguish between these organs and the true castor sacs. In addition to previous accounts, he states that castor provokes sneezing when smelled, enumerates the nervous diseases in which it is useful —including tetanus, neuralgia, and paralysis—and adds that it is an antidote to the stings and bites of venomous insects.[4] Galen refers to its virtues in low fevers and in flatulent colic, and speaks of inhaling its fumes from live coals. Avicenna says, among other things, that it remedies the excessive operation of hellebore. Sofia mentions its efficacy in nervous palpitation of the heart, and another writer compares its action to that of musk.[5] In later times the use of castor became more restricted, and although here and there it was still recommended for tetanus, whooping-cough and even epilepsy, it was more generally directed for the relief of accidental spasms.[6] Even in these affections it was seldom used

[1] For information on the history, dissemination, etc., of the beaver, see an abstract of a paper by Dr. Charles Wilson, Edinb. Med. Journ., iv. 82.

[2] Dierbach, Arzneim. des Hippokrates, p. 229.

[3] Liv. ii. chap. xxiii.

[4] Liv. xxxii. chap. xiii.

[5] Ebn Baithar, ed. cit., i. 262.

[6] Strumpf, i. 1042.

alone, but generally in union with more powerful antispasmodics, to which, indeed, the effects of the combination must be mainly attributed. The high price of the best castor, and the inefficacy of the ordinary specimens found in commerce, have combined very greatly to restrict its use in medicine.

Action.—Experiments upon healthy persons would seem to prove that the action of castor upon them is almost null. Thus, in 1768, Alexander used it in various doses, to the extent of two drachms, without experiencing any other effect than disagreeable eructations.[1] Jorg and his associates took doses of this substance varying from one to twenty-four grains, but, except repeated eructations, and a persistent bitter taste in the mouth, no striking symptom was manifested, either by the skin, or by the digestive, vascular, or nervous systems. From these experiments it was inferred that castor is merely a very indigestible substance, and one unworthy of being retained in the materia medica. But, as Richter has pointed out,[2] such a conclusion is unwarrantable; for not only does unquestionable evidence of the antispasmodic virtues of castor abound, but many other agents, also, which have no perceptible influence on healthy persons, exert a decided power upon the sick, even when given in small doses. A familiar example of this truth is presented by alcoholic stimulants. Thouvenel, however, states that two drachms of the residue obtained by evaporating the ethereal tincture of castor augmented his nervous energy, produced a sensation of heat in the epigastrium, and rendered the pulse more frequent.[3] In persons of a highly nervous temperament, and in females actually affected with hysteria, it has been found to excite the pulse, increase the warmth of the skin and the cutaneous transpiration, and, in large doses, to produce some fulness and dulness of the head.[4] It is also alleged by Thouvenel to increase hysterical attacks in morbidly susceptible females when given alone, but in combination with opium to produce the best results. A similar opinion is expressed by Richter. Other authorities, moreover, ascribe to it a power of lessening the narcotic action of opium, while it derives from combination with this medicine an increase of its antispasmodic powers.

Uses.—Castor has been employed and vaunted in the treatment of a number of diseases in which derangement of the nervous system forms either the principal or a subordinate element. Among diseases of the first class may be enumerated hemicrania, spasm of the œsophagus, and hysterical spasms of every variety;[5] and among the latter, muscular subsultus and agitation occurring in low fevers, also hiccup, flatulent colic, and spasmodic dysmenorrhœa. Yet, even when it operates most favorably in purely spasmodic affections, it can only be regarded as a palliative, capable of alleviating

[1] Experimental Essays, p. 83 et seq. [2] Op. cit., iii. 319.
[3] BARBIER, ii. 239. [4] STRUMPF, loc. cit.
[5] It has also been recommended, with Peruvian bark, in whooping-cough, by Dr. MORRIS, Med. Obs. and Inq., iii. 281.

the existing paroxysm, but without further efficacy in the disease. When hysteria is connected with abdominal cramps and tympanitis, with uterine colic and scanty menstruation, a case is presented in which, by the concurrence of all the older authorities, castor is peculiarly useful. More recent observers have confirmed their statements. Trousseau and Pidoux limit their description of the indications referred to by mentioning only amenorrhœa and painful tympany of the abdomen. Allusion is made to those cases of *uterine tenesmus* in which the paroxysms of expulsive pain are accompanied with the discharge of only a few drops of blood. It may be doubted, however, whether the tenesmus in these examples is not more promptly and effectually relieved by belladonna, and the accompanying tympany by fetid enemata. Richter is of opinion that castor is very prejudicial to persons of a certain constitution, which he describes as a relaxed organization, connected with great susceptibility, excitability, and a tendency to inflammation. But so exact a determination of the virtues of such a medicine as castor may be suspected of being hypothetical.

The value of castor in the nervous forms of low fevers, if real, is so far inferior to that of valerian, opium, and the diffusible stimulants, as to demand no more than a passing notice. It seems to be chiefly indicated in the flatulent colics which sometimes arise in these affections, either spontaneously, or, what is more common, perhaps, from the injudicious use of purgatives. Cloquet, however, is reported to have used it with advantage in the last stage of adynamic fevers, but whether alone or in combination does not appear.[1]

Administration and Dose.—Castor may be administered in *substance*, in doses of from ten to one hundred and twenty grains, according to the quality of the specimen employed. The dose of the *tincture*, which is officinal (TINCTURA CASTOREI), is from half a fluidrachm to two fluidrachms. As ordinarily found in the shops, castor and its preparations cannot be depended on; and even if the finest quality of Russian castor were always accessible, its extravagant price and very limited usefulness would render it a luxury that might easily be dispensed with.

MOSCHUS.—MUSK.

Natural and Medical History.—Musk is a peculiar concrete substance obtained from *Moschus moschiferus*, an animal found in Central Asia, and which chiefly inhabits the mountainous regions lying between Siberia, China, and Thibet. This animal bears some resemblance both to the goat and the deer, but is without horns, and its canine teeth are very long, prominent, and curved. It lives on thickly wooded mountains, and is extremely timid. The musk sac, which is found upon the belly of the male, and behind the

[1] MÉRAT and DE LENS, op. cit., ii. 140.

umbilicus, is an oval pouch covered by the abdominal integuments, and presents on its under face a longitudinal groove which lodges the anterior extremity of the penis. The sac itself is formed by three membranes, the internal one of which is thrown into folds which form septa and cells in which the musk is secreted. The opening of the sac is immediately in front of the orifice of the prepuce. In the living animal the musk is semi-fluid. It is most abundant in the adult, and during the rutting season, at which time, also, its odor is strongest. The object of this secretion has by some been conjectured to be the excitement of the female organs during the act of coition; it is also regarded as analogous to the sebaceous secretion which is formed within the prepuce of other mammals; but the two explanations do not conflict with each other.[1]

As found in commerce, musk is in small, dark-brown grains, and has an unctuous feel. Its taste is bitter and rather acrid, and its odor extremely penetrating and permanent. It is soluble in hot water and in alcohol, ether, and the yelk of egg. Besides neutral animal matters, it contains ammonia, a volatile oil, and a fatty substance.

The strong and permanent odor of musk is not due to a volatile principle, for it cannot be driven off by distillation, nor isolated in any manner. When dried by the help of sulphuric acid, it loses its odor for the time, but when moistened directly, or allowed to attract moisture from the air, it regains its smell. Geiger and Reimann dried and moistened musk alternately for thirty successive times, but without in any degree impairing its odor. These facts have given rise to a belief that the smell of musk depends upon a gradual but incessant decomposition of the substance. It has also been suggested that as the extrication of ammonia causes the volatilization of particles which are naturally inodorous, and as it is proved that ammonia is constantly given off by musk, therefore the odor of this substance is developed by the continued extrication from it of ammonia. The same odor, it may be mentioned, is one of the most common in the vegetable and animal kingdoms. The musk geranium, the musk rose, the musk melon, etc., are familiar examples. Several substances, among which bile may be mentioned, exhale it while undergoing decomposition. It strongly impregnates the exhalations of some females during the menstrual epoch, and especially of the negro and mulatto. Dr. Graves relates a case of delirium tremens which was treated by opium only. After the first day or two of the attack the patient began to perspire very profusely, and to exhale so strong an odor of musk that it very soon filled the whole house.[2]

Musk appears not to have been known to the early Greek or Roman physicians. Most of the Arabian writers celebrate its virtues, which they represent as cordial, stomachic, antispasmodic,

[1] Dieu, Mat. Méd., i. 507 et seq.
[2] Clinical Medicine, p. 816.

and aphrodisiac.[1] It began to be spoken of in Europe during the sixteenth century, as a remedy for hysteria, and the fact was then already noted that in very sensitive persons its odor was capable of bringing on hysterical attacks.[2] It was, however, chiefly celebrated for its power of allaying such paroxysms; according to Wedelius it was a "divine remedy" for lipothymia, syncope, palpitation, and asphyxia, and Schrœckius places its power of relieving soporose affections, lethargy, and coma, in the very first rank. Upon its introduction into European practice, and indeed until the last century, it was regarded as a sovereign remedy for a great variety of affections. It is now almost as much neglected. The exorbitant price which the drug commands, and the difficulty of obtaining it pure, have no doubt contributed to restrict the field of its usefulness.

Action. *On Animals.*—Tiedemann injected five grains of musk, dissolved in two ounces of water, into the crural vein of a dog. Respiration was quickened, and the expired air smelled of musk; the pulse was not rendered more frequent, nor was the temperature of the animal increased. Partial insensibility followed, and a cataleptic condition; there were slight spasms during sleep, tetanic phenomena, copious and bloody stools, coma, infrequent respiration, a thready pulse, and then death. The muscles were found to be rigid; the intestinal mucous membrane was reddened, and the canal contained dark blood, as also did the veins.[3]

On Man.—Tralles, in 1783, pointed out the following qualities of this drug. It has a great and wonderful power over the whole nervous system, quickens the circulation, raises the animal temperature, congests the brain, producing drowsiness and intoxication, and causes a sense of oppression and anxiety in the chest.[4] According to Sundelin, about fifteen minutes after taking a scruple of musk, a feeling of excitement or intoxication is experienced, with a quickened, full, soft, and somewhat more frequent pulse, and the skin is slightly moistened. These symptoms continue for about two hours, and do not leave behind them the least sense of lassitude or confusion of the senses. The breath, perspiration, and urine diffuse a strong musky smell even upon the day following the experiment.[5] Barbier found the same smell also in the excretions of those who had taken musk, and could detect it upon his own fingers after merely feeling the pulse of one of those persons.[6] The breath and eructations of a patient to whom an enema containing musk had been administered, offered its characteristic smell and taste; and the serous cavities, and indeed the whole body, were found impregnated with the odor in the case of a person who had taken musk immediately before death.

[1] PAUL. ÆGIN., Comment. Adams, iii. 469.
[2] Vid. TRALLES, inf. citat.; and SCHRŒCKIUS, Ephemerid. Acad. Nat. Cur., 1688, p. 231.
[3] MITSCHERLICH, op cit., ii. 371.
[4] Com. de rebus in Sci. Nat. et Med. gestis. xxvi. 434.
[5] STRUMPF, op. cit., p. 1031.
[6] Mat. Méd., ii. 231.

The following are the results of Jörg's experiments with this substance. The medicine was administered to eight healthy persons, including himself. Doses of from one-half to five grains induced no other phenomena than eructations in which the odor of musk was very strong. Doses of from four to fifteen grains were followed by fulness and oppression at the epigastrium; by an increase in some cases, and in others by a diminution, of appetite; the throat and œsophagus were dry, yet there was no thirst; there was slight wandering of mind and giddiness, tightness about the temples, neuralgic pains of the head, and some disturbance or weakness of the mind. In several cases, gaping, drowsiness, and lassitude followed, and several sensitive persons displayed considerable excitement of the nervous system, and quivering or twitching of the whole body. In general the pulse was more frequent by several beats than usual, and at the same time rather fuller. In some cases there was an increased sense of warmth, and moderate perspiration. The operation of the drug usually terminated in six or eight hours, yet several persons more impressionable than the rest had musky eructations, and felt drowsy, for twelve or eighteen hours. The ensuing sleep was deep and long. Contrary to the observations of other experimenters, Jörg found that neither the urine nor the perspiration smelled of musk, but in some cases the former exhaled a strong ammoniacal odor.[1]

Strumpf thus indicates the modified action which certain morbid states induce in the operation of musk. While large doses, or small ones frequently repeated, occasion in healthy persons more or less oppression and nervous agitation, they, on the other hand, secure repose and strength to those in whom the nervous system is enfeebled or deranged, imparting animation and freedom to the action of the brain, and restoring the lost balance of the vital forces. When duly administered to the sick, it gives vivacity to the eyes, often causes a slight injection of the conjunctivæ and flushing of the cheeks, a fuller and somewhat slower pulse, warmth of the skin, perspiration, increased discharge of urine, and some irritation of the genital organs. When this excitement of the whole nervous system is followed neither by a natural state nor by an amelioration of the disease, the ultimate condition of the patient is one of greater debility than at first.

Hiltscher[2] ascribes to musk almost exactly the same qualities as those just pointed out, and dwells upon the necessity of giving full and repeated doses in order to develop its effects distinctly. He also blames the custom of prescribing the medicine only as a last resort, a custom which, he says, has led the sick and their friends also to look upon the prescription of musk as a sentence of death.

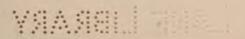
Remedial Employment.—In *febrile affections*, distinguished by *ataxic* rather than typhoid symptoms, or, to use the distinction of Vogt,[3] when the nervous is more deranged than the vascular sys-

[1] Materialien, p. 285.
[2] SOBERNHEIM, op. cit., 192.
[3] Lehrbuch, etc., 269.

tem, in *febris nervosa versatilis* rather than in *febris stupida*, musk is indicated; for, in pure typhus, when *prostratio virium* is the most prominent symptom, it is more mischievous than useful, while wine is almost a specific. The distinction here pointed out is probably the one aimed at by M. Pidoux when he attempts to define ataxia pathologically as follows: "Ataxia consists in a want of unity between the nervous and the organic functions, for in this proportion and in the degree of its force or firmness the life of the individual and the degree of his vital resistance abide."[1] The state alluded to will be best understood by means of a description. It usually presents itself after the more active and open symptoms that mark the invasion of the attack, while the pulse is moderately strong and full, the countenance animated, and the vitality of the skin unimpaired. The eye is then observed to grow dull, the hearing becomes impaired, the breathing is anxious and sighing, the speech feeble and stammering; there is a mild muttering delirium rather gay than sombre, floccitation, muscæ volitantes, and hiccup; the tongue is tremulous, and may be brown and dry, smooth and polished, or uneven and pasty; there is subsultus tendinum and twitching of the facial muscles and of the lower limbs; the skin is hot, dull, dirty, dry, and harsh, or else covered with a profuse sweat; and the pulse is small, frequent, tremulous, and irregular. This state tends to pass into coma or collapse, in either of which musk would be as unavailing as improper; but to counteract the symptoms which have been described, nothing acts with more promptness or certainty. This is doubtless the state which Cullen had in view in the following passage:—

"We abstain from musk in inflammatory cases, or in cases where the diathesis phlogistica is supposed to exist, and in topical affections of the brain; but I am disposed to say that even in these cases it may be employed with more safety than opium, so far as my experience goes; and in fevers, without much nicety in discerning the circumstances, wherever the symptoms of *strong spasm* appear, where there is a *delirium*, *subsultus tendinum*, and *convulsive motions* without the irritation being remarkable, and where we presume the disease to be in the nervous system, there musk has been of considerable service."[2]

Sarcone, who used the remedy very extensively in the epidemics of Naples, is thus cited by M. Dévay in a paper on *Malignity in Febrile Diseases*.[3] After describing the ataxic condition, he thus portrays the effects of musk: "It was a delightful thing to see patients who had been convulsed pass by degrees from a peaceful sleep into a state of drowsiness that lasted for several hours or even days. Subsequently the pulse began to be undulating and decidedly quickened, the skin was often covered with a warm, general, and often offensive sweat; the urine began to flow with ease, and seemed to contain a whitish deposit; and putrid stools, or the dis-

[1] Op. cit., ii. 202.
[2] The Works, etc., 1838, i. 633.
[3] Rev. Méd., Juill. 1843, p. 334.

charge of a foul and stinking serum, took place." "We have several times," says M. Dévay, "had occasion to confirm the remarks of Sarcone. In the course of four months we met with six cases of ataxic typhoid fever, in which the nervous system was greatly deranged, and in which the use of musk liberated, as it were, the chief disease from these accidental complications, and restored it to its simple state. The same effect took place in two cases of confluent smallpox, in which at the commencement of the eruptive stage there was delirium, with jactitation and convulsive movements. The medicine was prescribed in pills of three grains each, to be taken every hour."

Many writers describe with high eulogy the benefits of musk when *ataxic phenomena*, like those above described, occur in *pneumonia*. Believing, however, that these phenomena are rare as symptoms of simple pneumonia occurring in healthy persons, we became interested to learn, as far as possible, under what circumstance the ataxic symptoms are said to have risen. The cases examined were contained in a paper of M. Padioleau,[1] and in the work of MM. Trousseau and Pidoux. It appears that depletory and sedative measures were adopted to a frightful extent. In the first case of M. Padioleau the patient was bled "several" times; in the second, four; and in the third case, six or seven times, while leeching, antimony, and blisters were also employed. In the remaining cases it is said that depletion was carried "as far as possible;" that the ataxia supervened "suddenly after venesection;" that bleeding was performed "several times;" that "under the influence of antiphlogistics and antimonials the nervous susceptibility increased, and a violent and ataxic delirium supervened;" and that, "after the most energetic use of the antiphlogistic, contro-stimulant, and revulsive treatment, the delirium increased frightfully." It may be added, one of the cases was that of a man attacked with pneumonia while drunk, yet he was bled and had tartar emetic given him. M. Pidoux remarks that "the gravity of the nervous symptoms was not fully explicable by the severity of the local lesion;"—they are only too readily explicable by the character of the treatment applied to a drunken man. Indeed, in the whole number of cases there is not one in which the ataxic symptoms did not clearly depend upon the unwarrantable use made of depletory and sedative measures. These, then, are not fitting examples of the power of musk to cure the ataxia which arises from natural causes; nourishment, wine, and opium would perhaps, probably indeed, have triumphed quite as readily over symptoms which were the natural fruits founded, not on clinical experience, but upon a pathological hypothesis. The general testimony of medical writers is, however, favorable to the virtues of musk in ataxic pneumonia and other inflammations of the same type; and it would perhaps be more available in this state when it occurs spontaneously through the violence of the disease, or, what is more probable, from the con-

[1] Bull. de Thérap., xvii. 265.

stitution of the patient, than when it is indirectly generated by an unwisely debilitating treatment. There remains a still purer form of ataxia in which the benefits of musk are not problematical; a form in which typhoid symptoms do not exist, but those rather of febrile delirium, and which are only to be distinguished from the latter by the absence of sthenic fever of a high grade. It is thus described by the authors last quoted: "It is purely nervous and maniacal. The brain is in a state of violent excitement, the patients are agitated, insist upon getting up, and rave with furious activity, precisely as if they were under excitement from alcohol. Indeed this sort of delirium is apt to break out in the pneumonia of drunkards." Musk will generally control these symptoms. So, too, will opium, either alone or in conjunction with musk, or with Hoffmann's anodyne, or with alcoholic stimulants prudently administered.

In various *spasmodic affections* musk has been successfully employed. In convulsive *hiccup* it is mentioned favorably by Whytt and by Wall. The latter states that two persons laboring under subsultus tendinum, extreme anxiety and want of sleep, occasioned by the *bite of a mad dog*, were perfectly relieved by two doses of musk of sixteen grains each. Dr. Huck relates a case of recovery from *traumatic tetanus*,[1] in which musk formed the main element of the treatment. Cullen states that he "once had a gentleman affected with *spasm of the pharynx* preventing deglutition and almost respiration. This, when other remedies had failed, was relieved by the use of musk, which often showed its power; for the disease continued to recur at times for some years after, and was only obviated or relieved by the use of the musk." Dr. Owen relates a case of *hysterical convulsions* which was cured by this remedy.[2] The patient, a young lady of seventeen, received a slight electrical shock, and a few hours afterwards experienced similar sensations to those she had received from the Leyden jar. After occurring at intervals for several months, and gradually growing stronger, they at last assumed the form of strong hysterical paroxysms. A variety of antispasmodics, including musk as well as tonics, were employed unavailingly, when at last musk alone, in doses of half a drachm repeated every four hours, was prescribed, and the paroxysms at once began to abate. As often as the use of the medicine was suspended, the fits returned, but less violently, and they were again arrested when it was renewed. The cure was completed by the use of chalybeate waters. In *spasmodic croup* musk is highly recommended by many German writers, who furnish satisfactory evidence of its curative powers; but it has no greater virtues, and probably, indeed, less, than emetics and revulsives in this affection, and is a far less accessible and manageable remedy. M. Salathé, of Mulhouse, claims to have cured all but two of twenty-four cases of *laryngismus stridulus* in infants, by the use of musk.[3]

[1] Med. Obs. and Inq., iii. 330. [2] Ibid., 183.
[3] Actes de la Soc. Méd des Hôp., 4ème fasc. (1859), p. 65.

But when it is remembered that the disease so called is in reality a symptom of various pathological conditions, some of which are trivial, and others mortal, we should greatly err in expecting to cure it uniformly by this or any other remedy. The report of M. Salathé is valuable in one respect, however; it proves the virtues of musk in purely nervous cases of the disease. The dose of musk in such cases is for infants one-fifth of a grain, at first, repeated every two or three hours. Subsequently it should be gradually increased. In *spasmodic coughs*, *vomiting*, *colic*, *chorea*, *etc.*, this medicine has been more or less eulogized by various authors, but on reviewing the evidence on which their opinions rest, it is difficult to accept them unreservedly. All that can be credited is that in these affections musk may be employed as a palliative of moderate efficacy. In proportion as the nervous element of the disease is predominant, may good be anticipated from its use, especially where the inflammatory element is in a like proportion weak.

In *retrocedent gout* the powers of musk are vouched for by Cullen. One of his patients was frequently attacked by this disease, affecting the stomach, the lungs, and particularly the head with violent pain and delirium. Many of the paroxysms were very suddenly relieved by large doses of musk, repeated at short intervals.[1]

Administration and Dose.—Musk is usually administered in the form of *pill* or *emulsion*, and in doses of ten grains and upwards, repeated every two or three hours. To children it may be given in an enema containing one or more grains of musk. A *tincture* of musk has been employed as an adjuvant to the preceding forms of administering the medicine; but the quantity of such a preparation required to represent the average dose of musk must contain too much alcohol to be frequently repeated.

CAMPHORA.—CAMPHOR.

Description.—The officinal source of camphor, *Camphora officinarum*, is a native tree of China and the adjacent islands. Camphor is, however, a widely diffused product of the vegetable kingdom. Millot defines it to be an organic product of several plants, which is distinguished by being solid, flexible, white, translucent, of a peculiar odor, and an acrid taste, which leaves a sense of coolness in the mouth, and is extremely volatile.

When small fragments of camphor are thrown upon water, mercury, or wine, they assume a circular, and often at the same time a rotary, motion. If a cylinder of this substance is floated vertically to half its depth in water, it becomes corroded, and is at last completely severed at the surface of the water. The former of these curious experiments has been explained by attributing the described motions to the reaction of the emanations of the camphor against the surrounding water.[2]

[1] Mat. Med., ii. 381.

[2] DIEU, op. cit., iii. 596.

Camphor is insoluble in alkaline solutions, and is very slightly soluble in water; but is perfectly so in alcohol, chloroform, ether, oils, and acids. Its sp. gr. is 0.9857.

The following preparations of camphor are officinal:—

AQUA CAMPHORÆ.—*Camphor Water.*

This is a filtered solution of camphor one hundred and twenty grains, alcohol forty minims, and carbonate of magnesia half a troy-ounce, in two pints of distilled water. *Dose*, a fluidrachm and upwards.

LINIMENTUM CAMPHORÆ.—*Liniment of Camphor.*

This is merely a solution of three troyounces of camphor in twelve troyounces of olive oil.

LINIMENTUM SAPONIS.—*Soap Liniment.*

Four troyounces of soap, in shavings, are digested to solution in two pints of alcohol and six fluidounces of water, and, after filtration, mixed with two troyounces of camphor and half a fluidounce of oil of rosemary.

Under the title of LINIMENTUM SAPONIS CAMPHORATUM (*Opodeldoc*), a preparation was formerly officinal, which had the advantage of containing a powerful stimulant essential oil (oil of origanum), and of possessing the consistence of an ointment. It seems to have been discarded upon pharmaceutical rather than upon therapeutical grounds.

SPIRITUS CAMPHORÆ.—*Spirit of Camphor.*

This is a solution of four troyounces of camphor in two pints of alcohol. It is inappropriate as an internal medicine, unless suspended in syrup or mucilage. *Dose*, ten to thirty drops.

Medical History.—Camphor was introduced into western medicine by the Arabians, who have also left us the earliest description of its virtues. Serapion is the ancient authority from whom the fullest account of this drug is derived. According to him, it is applicable to inflammations, vertigo, and cholera, is anaphrodisiac, induces permature whiteness of the hair, and arrests hemorrhages. Other Arabian authorities state that in large doses it causes indigestion, is an astringent of the bowels, and produces impotence.[1] The last named quality is celebrated in a distich of the Salernian school—"Camphora per nares, castrat odore mares."

In modern times camphor has been ranked among the most useful remedies. Its vogue has, however, greatly declined during the present century, in consequence, it may be presumed, of the controversies concerning its action which divided the medical world; for while several of the most eminent authorities regarded it as a sedative, others, of no less distinction, maintained it to be a stimulant. As too often happens on such occasions, the contending parties were more zealous in refuting one another than anxious to establish the practical value of the subject of their dispute.

[1] ADAMS, Comment. on Paul. Æginet., iii. 427.

Action. *On Plants.*—Withered plants revive with remarkable quickness in camphor-water, but ultimately perish under its influence. Cut portions, according to Göppert and Miguet, become brown and dry more or less quickly, according to the course of their vessels and their structure. Plants that secrete a milky fluid lose this faculty, and such as have a motor power are paralyzed. Plants sprinkled with camphor are speedily and certainly killed, and the color of their flowers is changed by it. Only to the lowest class of the vegetable kingdom is camphor innocuous; mould will even form in glasses that contain it, and animal and vegetable substances moistened with a solution of camphor grow mouldy as readily as if water were employed alone. Camphor does not interfere with the germination of seeds.[1]

On Animals.—Menghini found that the effluvium of camphor is fatal to many of the articulata, when they are inclosed with this substance in a glass vessel with a paper cover, pierced with holes so as to admit the air. Beetles, bedbugs, ants, wasps, fleas, spiders, and lice are sensibly affected by its emanations, which ultimately destroy them. According to the same experimenter, birds, such as sparrows, swallows, chickens, pigeons, etc., are all more or less acted upon; some of them are seized with epileptiform convulsions, others with a sort of intoxication or madness, and still others fall into a state of stupor, or give signs of distress, with stertorous breathing, hiccup, or frothing at the mouth, while in some cases a purgative, emetic, or diuretic action is manifested. Most frequently the death of the animal speedily follows these symptoms; and, on dissecting them, various signs of inflammation are detected in the meninges, lungs, heart, and intestines, and the blood is in some instances fluid, but in others coagulated. Monro produced sluggishness, syncope, and a marked slowness of the heart's movements, when camphor was given to frogs, either by the mouth or applied to the skin. Carminati placed frogs under glasses having a capacity of four cubic inches, along with a piece of camphor weighing three drachms, and at the expiration of fifteen or twenty minutes the animals became agitated, breathed laboriously, and died convulsed.[2]

The experiments of Heubner[3] led him to the conclusion that when camphor is made to act immediately upon the frog's heart, it operates, in small quantities, as a direct stimulant, increasing the power of the heart's contraction; but that relatively large doses produce a directly opposite effect, depressing and paralyzing the organ.

Camphor is very generally fatal to the intestinal entozoa of man. One of the most familiar uses of this substance is to prevent the attacks of moths upon woollen fabrics, by sprinkling it among them, or by inclosing them in chests made of camphor-wood. This well-known fact appears not to harmonize with the statement

[1] STRUMPF, i. 710. [2] DIEU, loc. cit.; MURRAY, App. Med., iii. 474.
[3] Arch. der Heilkunde, xi. 334.

made by numerous authors, that camphor does not act injuriously on the *tineæ* that destroy wool.

Experiments upon dogs and other animals have been made by numerous observers, whose results are comprised in the following summary. Five or ten minutes after a dog has taken from one and a half to two drachms of camphor, dissolved in oil, the animal grows restless, foams at the mouth, makes violent efforts at swallowing, his gait is unsteady, and he soon lies down; but shortly afterwards, and as if aroused by an electric shock, he starts up, vomits, or attempts to do so, and again lies down. These acts occupy about a quarter of an hour. He then begins to tremble, and is convulsed, throwing his head backwards; his movements grow disordered; he whines, and tries to escape; his throat becomes obstructed with frothy mucus; his eyes are generally fixed, and the pupils dilated. The breathing meanwhile is anxious, and the pulse feeble. This convulsive state is generally followed by repose, during which the heart beats more feebly and less frequently, while the nose is cold and the whole body trembles. Another and more violent convulsive paroxysm follows, which is again succeeded by an interval of repose; but the spasms are speedily renewed, respiration grows more labored, and the animal dies. During the progress of these phenomena, vomiting, with a discharge of urine and fæces, generally takes place. Their duration is usually from two to three hours; but if they do not terminate fatally, recovery speedily follows. When solid camphor is administered, the animal shows greater signs of suffering; he drinks greedily, and his pulse becomes quicker, but death ensues at a much later period than in the experiments previously described; not usually, indeed, for many days, nor from direct poisoning, as it does when camphor is administered in oily solution, but indirectly from inflammation of the stomach. This organ is found, on dissection, to be extremely vascular, and softened or ulcerated. No other cadaveric changes have been observed which serve to illustrate the cause of death.[1] The odor of camphor is detected in all the fluids and secretions after death; the heart is found distended, and its lining membrane, as well as that of the bladder, and the membranes of the nervous centres, are stained by the dark and fluid blood. Scudery found vivid traces of inflammation in the genito-urinary apparatus of a dog which had been poisoned with camphor, and had suffered severely from strangury during the progress of the experiment. Tiedemann and Gmelin could not recognize the smell of camphor either in the chyle or in the urine, but all observers have detected it in the expired breath.

When camphor is given in small doses to horses, oxen, sheep, etc., it is said to quicken the pulse and cause general excitement, and blood drawn from a vein flows more strongly and is redder than before the experiment. Larger doses, according to Moiroud, develop exalted sensibility and induce convulsions; and still larger

[1] Dieu, loc. cit.; Murray, App. Med., iii. 474.

quantities produce a greater degree of morbid sensibility, frequency of the pulse, convulsive paroxysms, and at last insensibility and an apoplectic condition.

The only conclusions which seem to be fairly deducible from the foregoing facts relative to the mode of action of camphor are these: 1st, that in *poisonous* doses it destroys life in the lower animals by depressing the vital actions of the system; and, 2d, that in *moderate* doses it acts as a stimulant to the nervous and circulatory systems. Some experiments of Scudery have been adduced by Dieu[1] to prove that camphor and opium are antagonistic. The experiments, indeed, showed that the poisonous effects of camphor are moderated by medicinal doses of opium. But the assumed interpretation of this fact could be sustained only by showing that the dose of the latter agent, if administered alone, would have been sufficient to produce the poisonous effects of opium. For otherwise it is only what might have been expected, that a moderate or stimulant dose of opium would tend to counteract an excessive or sedative dose of camphor; just as a small quantity of alcohol will moderate the secondary effects of an overdose of the same agent. So Scudery himself found that rabbits withstand for a long time the influence of poisonous doses of camphor dissolved in alcohol. No two agents can be considered antagonistic which do not produce opposite effects when given in the same relative doses. But the different action of small and of large doses of camphor will be more fully illustrated in the sequel.

On Man. Local Action.—When camphor is rubbed into the unbroken skin, it produces a sensation of heat or burning, but seldom causes inflammation. It excites severe pain, however, when applied to the denuded cutis. The local action of camphor on mucous membranes is more decided. A piece held in the mouth for half an hour excites redness, heat, swelling, and pain, and if retained there long enough, would probably also ulcerate the surface with which it is in contact, as it is known to do when it acts upon the gastric mucous membrane. When powdered camphor is sprinkled upon indolent and unhealthy ulcers, it produces a contraction of the tissues and hastens the cure. *The local operation, therefore, of camphor on healthy parts is that of a stimulant and irritant.*

Constitutional Action.—A diversity of opinion regarding the operation of camphor, it has already been stated, has long prevailed, a diversity quite as great as in the case of opium, and which would probably have engendered no less hostility and bitterness between the opposite advocates, were not the utility of the former medicine so far inferior. Like opium, camphor is held to be a stimulant by one party and proclaimed a sedative by another, and examples without number are cited by each to demonstrate its own thesis. This conflict of opinion may be harmonized, if, instead of accepting the deductions of authors as the elements of a judgment, the grounds of those deductions are themselves analyzed; for then it appears

[1] Loc. cit.

that, as in the case of opium, alcohol, and various other agents, the action of camphor varies with its dose, and further, that in certain doses its primary and secondary effects are of an opposite character. These statements will be more readily appreciated after a review has been taken of the facts upon which alone it is possible to base an enlightened and impartial judgment.

One of the earliest illustrations of this subject is furnished by Hoffmann.[1] The patient was a hypochondriac, to whom *two scruples* of camphor dissolved in oil were administered by mistake for spermaceti. Hardly was the dose taken, when the patient was seized with vertigo, his extremities grew cold, and his countenance pale; his pulse was small and very slow; there was præcordial distress, and a cold sweat broke out upon the forehead; the mind became disturbed, and the patient laughed loudly at one moment, and the next was depressed with a dread of dying. Volatile and stimulating liquids held to his nose increased the intoxication; the patient's limbs seemed weary, and when he boasted of his strength, he staggered in walking. In the course of two hours he began to come to himself, but was feeble and relaxed; a copious perspiration with a warm skin and frequent pulse followed, and he enjoyed a good night's rest.

Whyte relates the case of a gentleman who, in order to know what effects a large dose of camphor would have, swallowed *half a drachm* dissolved in oil. His head became confused, he staggered as he walked, and a dark cloud seemed to come over his eyes, but upon going into the open air these symptoms began to abate, and in a few hours passed away.[2]

A very similar case is recorded by Griffin. *Two scruples* were taken, and caused, besides the burning sensation at the pit of the stomach, a lessened frequency of pulse, vertigo, intoxication, slight shivering and a pale countenance, staggering, and finally sleep.[3] The same writer states that he gave *half a drachm* to another person. The pulse did not change at first, but after the lapse of two hours there was nausea with giddiness and dimness of vision; then active vomiting, after which the pulse became frequent, small, and feeble, with general debility, which continued for some time, especially in the lower limbs. According to Callisen, this medicine given to persons laboring under a malignant bilious fever, in doses of from *ten grains to half a drachm* every third or fourth hour, and in some cases every hour, produced in all of them a marked subsidence of the heat with paleness of the surface, dimness of vision, frequent and oppressed breathing, a less frequent but an unequal and intermittent pulse, and occasionally rigors. But these symptoms, which arose suddenly, subsided rapidly, and did not last more than half an hour; they were followed by a stronger and more regular pulse, easy respiration, warmth and redness of the skin, and brightness of

[1] Consult. et Respon. Med., cas. xix.
[2] Observations, etc., 2d ed., p. 366.
[3] MURRAY, Apparat., iii. 479, and GRIFFIN, loc. inf. cit.

the eyes.[1] Pouteau also relates the case of a puerperal female who, in the course of half an hour, took *a drachm* of camphor to relieve the pains of colic. She was seized with a death-like coldness and paleness which lasted nearly an hour.[2]

One of the best related cases on record illustrative of the present subject, is that of Alexander, who, in order to study the effects of camphor, took *two scruples* of it at a dose suspended in syrup.[3] He soon experienced an unusual lassitude and depression of spirits, accompanied with frequent yawnings and stretchings which stole upon him by degrees, till at the end of three-quarters of an hour they became extremely troublesome. His pulse had fallen from 77 to 67. "Soon after this," he continues, "my head grew so very giddy that it was with great difficulty I could walk across the room, when feeling myself, as I imagined, stifled, I imagined the fresh air would remove that symptom, and therefore opened the window and looked out; but everything in the street appeared to me in the utmost tumult and confusion; in which, imagining that I was involved, I felt myself in danger of losing my balance and tumbling from my position. I therefore staggered from the window to my bed, and having a book with me, read several passages of it; but had no distinct idea of any one sentence, and far less could I connect two or more of them together, so as to comprehend the meaning of the author. At last, being able to read no longer for the tumultuous motion which I perceived among the letters of the book, and finding it had no power to divert the attention of my mind from the uneasy sensations which disturbed me, I arose to see whether I could walk any better; but to my great mortification found my head more confused, and could scarcely walk any at all. I then returned to the bed, and, being a little thirsty, called for some mutton broth to drink. When the victuals were brought, I got out of bed again, and with no small reluctance swallowed a little of the broth, but could neither taste bread nor meat, on account of a nausea which, however, was not accompanied with any inclination to vomit. I now staggered again to bed, and took up the book I had left there, but could not read, as the letters on the book formed only a confused group of unsteady images. The confusion in my head now increased so much, attended with such a noise in the ears, that all knowledge of what was present, as well as the memory of the past, was soon entirely lost in a state of insensibility; so that I was entirely ignorant of what I did till my senses began to return.

"Fortunately, about this time, one of my young gentlemen came into the room, who told me afterwards that I desired him to shut the windows, and then threw myself backward on the bed, where I lay a few minutes very quiet, then started up, sat on the side of it, and made some efforts to vomit, but threw nothing up; then I flung myself back again with dreadful shrieks, fell into strong

[1] GRIFFIN, p. 481. [2] Ibid., p. 483.
[3] Experimental Essays, Lond. 1768, p. 128.

convulsions, foamed at the mouth, stared wildly, and endeavored to lay hold of and tear everything within my reach. This fit was succeeded by a calm, something similar to fainting, with this difference only, that my color was very florid. When Dr. Cullen soon after arrived, and felt my pulse, which beat one hundred in a minute, he ordered me to be blooded, but my natural antipathy against this operation made me obstinately refuse to comply. All this time no person knew anything of my having taken the camphor, nor did I recollect it myself, and though I was recovered so much as to know every one about me, I was entirely ignorant of my own actions, as well as of the place where I was.

"At this time, feeling myself very warm, I got out of bed, threw myself down on the floor, and thinking myself refreshed by the cold of it, called for some cold water, and bathed my hands and face in it. This refreshed me a little, and in some degree quieted a tremor which had seized on every part of my body. After drinking plentifully of warm water, I vomited; and though more than three hours had passed since I had taken the camphor, the greater part of it was evacuated, undissolved, along with the water. While I was holding my head over the basin into which I was vomiting, the smell of the camphor arose very strong from it, and to this circumstance it was owing that I first recollected I had taken it, though I could give no distinct account of the time when or manner how.

"I mentioned before that I had not only lost all remembrance of my past actions, but also the knowledge of every present object, but now I began slowly to recover both; my business, my connections, and everything of the same nature, which I had entirely forgot, at their first occurrence startled my mind as if they were things I had never before been acquainted with; and, what is still more extraordinary, after I knew every one of my family, I did not recollect the use of any part of the furniture of my own room, and every object on which I cast my eyes appeared as strange and new to me as if I had only that moment begun my existence.

"Between eight and nine o'clock, feeling myself still very much confused, I went to bed, and soon after fell into a very calm and easy sleep, which continued till next morning with much less interruption than usual." No unpleasant symptoms remained on the following day, except great soreness and stiffness of the whole body.

This case, which is almost unique in the minute and complete detail of its phenomena, is also different from any other in the peculiar disturbance of the nervous system which it displays. Neither the term stimulation nor sedation expresses the character of the symptoms taken in their aggregate, and such, indeed, was the judgment of Alexander himself concerning it. Nevertheless, if we set aside those of its phenomena which indicate neither an excitement nor a depression of the system, but their perversion merely, the remainder clearly demonstrate a diminished energy or tone in the circulatory and nervous system and their dependencies. Of such symptoms are these: depression of the pulse, lassitude,

giddiness, accompanied with debility, fainting, etc. They were the primary effects of the medicine, and were followed ultimately by heat of skin, frequency of the pulse, and headache.

The well-known case of Cullen's patient should find a place here. She took *forty grains* of camphor, and became insensible; her pulse was very weak and small, her breathing hardly to be observed, and her whole body pale and cold.[1] Duteau relates that *one drachm* of camphor was given to a girl in a very severe colic. After taking it, the pain soon became easier; but it brought on such an extreme cold over all her body as resembled death, and which could hardly be removed by the aid of warm cloths wrapt around her, and the internal use of wine.[2]

An instructive case was published by Wendt relative to a man who swallowed nearly four ounces of tincture of camphor containing more than *two drachms* of the latter substance, and who nevertheless recovered. Dieu, who cites this example, very plausibly attributes the safety of the patient to the stimulant effects of the alcohol in which the camphor was dissolved.

Trousseau performed some experiments in his own person for the purpose of elucidating the action of this medicine. After a dose of *ten grains* the pulse fell from 72 to 64, and then to 60; an acrid coldness was felt in the stomach, and at the expiration of an hour, although this symptom remained, there was a general sense of comfort. A dose of *twenty grains* produced the same effects in a more marked degree. A third dose of *thirty-six grains* occasioned a still stronger sense of cold, which seemed to pervade the whole trunk, but was especially felt in the œsophagus and the stomach. At the end of half an hour the pulse fell from 72 to 60, and there was a slight sense of heaviness. "The anaphrodisiac action was unquestionable." At the expiration of two hours the sense of coolness in the bowels was no longer felt, but in its stead a slight degree of warmth. Three hours afterwards the condition was the same as before the experiment. In these trials of the medicine, and especially in the last, the reader will be struck by the absence of several symptoms which occurred in all of the other cases in which so large a dose of camphor had been taken, viz., the coldness of the extremities, the confusion of mind, the vertigo, the weariness, and the debility. These and various alarming ataxic symptoms were produced in the person of Alexander by a dose of camphor only four grains larger than the last taken by M. Trousseau with such slight effect.

M. Aran reports a case[3] which goes still further to demonstrate the exceptional character of the symptoms described by M. Trousseau. The patient was a nervous and delicate female affected with neuralgia and various indefinite pains and sensations in different parts of her body. *Two scruples* of camphor suspended in water were given her by enema. Hardly had two minutes elapsed when

[1] Mat. Med., ii. 295. [2] ALEXANDER'S Essays, p. 141.
[3] Bull. de Thérap., xli. 164.

the patient complained of a faintness which seemed to threaten dissolution, and of a severe pain in the belly. Almost immediately afterwards she became insensible and was convulsed; the limbs were contorted, the head thrown backwards, the face purple, and the lips covered with foam. The fit lasted twelve minutes. Soon afterwards M. Aran found her in the condition described, and with the eyes half open, the pulse between 70 and 80, and extremely small, the extremities cold and livid, and the respiration suspended. The patient regained her consciousness on water being sprinkled on her face, but complained of pain in the abdomen and a sense of suffocation which lasted several hours. A purgative enema was administered and strong coffee prescribed, but very soon after, although she had meanwhile evacuated a portion of the camphorated enema, the former symptoms were renewed, and were mitigated by a stream of cold water falling upon the head. The coldness and insensibility persisting, the patient was placed in a warm bed, and wine with canella administered. From this time reaction came on, the trunk grew warm and even hot, the pulse rose and became frequent (88–92), and in four hours after taking the camphor the only remaining symptoms were fever, redness of the face, heat of skin, and a sense of weariness and debility, which by the morrow were completely dissipated. The patient had no recollection whatever of the incidents of this attack.

A very similar case in respect of the symptoms, but remarkable for the early age of the patient, is related by Lemchen.[1] A male child, twenty months old, swallowed a small quantity of camphorated oil. Probably an hour must have passed before any effects were noticed, when the child appeared languid and dull; soon afterwards he grew very pale, and then insensible, and his limbs became rigid, the head being retracted. The skin was cold and insensible, and the face cyanotic; there was internal strabismus, the pupils were contracted and insensible to light, the pulse was rapid and thready, the action of the heart irregular. The muscular rigidity, which was not of long duration, was succeeded by a spasmodic twitching of the limbs. After vomiting, excited by ipecacuanha, the patient became more quiet, the skin regained its warmth and color, and soon grew hot, while the face was burning, and the pulse full and frequent. Cool applications to the head and whole surface of the body reduced the heat; the child slept peacefully the whole night, and on the morrow had quite recovered.

Another example of the sedative effects of large doses of camphor is related by Orfila.[2] In this case a dose of *thirty grains* was administered in clyster to a man of nervous temperament. A few minutes afterwards the taste of the medicine was perceived in his throat, and within a quarter of an hour a sense of uneasiness and anxiety took possession of him. On rising to walk he seemed to move over the ground without touching it, and his step was wavering and tottering. His face was pale, his eyes haggard, and his features

[1] Bull. de Thérap., lxxii. 278. [2] Toxicologie, ii. 643.

pinched. A slight sensation of coldness pervaded the whole surface of his body, and a sense of numbness the scalp and back of the neck. In some places the skin was cool and moist, the pulse was small and feeble, and there seemed to be a disposition to syncope, etc. Wine contributed greatly to his recovery.

Orfila quotes from Schaaf the case of three children, to each of whom about *thirty grains* of camphor in powder were given. The first symptom observed was extreme paleness of the face, with a fixed and stupid look; then followed delirium, thirst, vertigo, vomiting, convulsions, and insensibility. The skin was cool, pale, and moist. One of the children, a delicate and sickly infant, eighteen months old, died from the effects of the poison. The only other recorded case in which camphor was the cause of death, and in this instance, as in the last, by an indirect effect, is that of a woman four months gone with child, who took three drachms of camphor dissolved in brandy at a single dose. It produced the usual symptoms, followed by an abortion which proved fatal.[1]

On analyzing the cases of which the more important details are given above, there is found to be a remarkable agreement in their symptoms, the character, if not always the degree, of the disturbance being identical in all of them. The cases are thirteen in number, in nine of which the dose of camphor taken varied from two scruples to a drachm; in the remaining four it averaged about half a drachm. In nine, of which the condition of the nervous system is described, vertigo, faintness, confusion of ideas were present, and either delirium or insensibility, debility, staggering, and convulsions. The temperature of the body was cool in all of the cases in which its condition is mentioned; the face was pale and the pulse either infrequent or small and feeble. This striking uniformity in cases observed in places remote from one another leaves no doubt upon the mind as to the *modus operandi* of camphor given in doses of from twenty to sixty grains. The medicine in these doses is proved to be a direct and powerful sedative, but transient in its operation. This is its primary and principal quality; indirectly, and chiefly perhaps where there is an undue nervous susceptibility, it creates in addition ataxic phenomena; and, lastly, and indirectly also, these effects are followed by some degree of febrile reaction, which is also of brief duration. In no instance does camphor seem to have directly caused the death of a healthy person.

Several cases are recorded which may be regarded as transitional between those above described, and those which are next to be considered—cases in which, although the total dose of camphor taken within a short time was large, yet the amount taken at any one moment was small. The first of these is the case of Dr. Eichhorn,

[1] Bull. de Thérap., lvi. 343. Later examples of the toxical action of camphor will be found in Lancet, May, 1857, p. 475; Am. Journ. of Med. Sci., July, 1858, p. 284; Times and Gaz., Dec. 1858, p. 645; Br. and For. Med.-Chir. Rev., April, 1861, p. 550; Dublin Quart. Journ., May, 1861, p. 467; Bull. de Thérap., lxxii. 278; lxxvi. 378: Practitioner, lx. 210.

related by himself.[1] He had powdered some camphor with sugar to relieve a cold in the head, and in the course of three hours took a teaspoonful from time to time without reflecting upon the quantity he was swallowing, but which was really about *two drachms.* He then went to bed somewhat alarmed lest he were poisoned, but for half an hour suffered no inconvenience. Presently, however, he began to feel warmer and warmer until he experienced a burning heat; his pulse grew very frequent, but there was no uneasiness in his head. He says: "I never felt better; never were my ideas more lively or clearer; it appeared as if my intellectual powers were increased, and certainly champagne never brought on a more pleasing intoxication. In this situation I passed about an hour and a half, when my skin began to grow moist; soon after my pulse became slower and I fell asleep. The next morning I awoke miserably weak, the sweat having penetrated to the lower side of the feather-bed, and my shirt and clothes were drenched."

The other example is reported by Dr. Reynolds,[2] of Brockville, Canada. "Mr. C., æt. 20, of a healthy constitution, and full habit, was standing in a shop where a druggist was breaking up cakes of camphor to put in bottles. He began to eat the crumbs of camphor, and unconsciously swallowed, bit by bit, probably *from one to two drachms* in the course of a few minutes." He suddenly experienced a degree of headache, and went out into the street, where he met a friend, to whom he proposed a rubber of whist. He felt unusually clear-headed; but soon after sitting down his gestures and conversation became very strange and wild. "Leaving the room suddenly, he retired to his bedroom adjoining, and returned, to the no small astonishment of his friends, naked, and dancing wildly about, and attempting to jump out of the window. His pulse was 180 and small; conjunctiva injected; pupil not much dilated, scarcely sensible to light; countenance pale and haggard; breathing hurried, and at times greatly labored; a frequent desire to make water, with some pain in the course of the spermatic vessels; urine quite clear, but having, as well as the perspiration, a strong odor of camphor; and a clammy sweat breaking out over the body." Opium was administered, which, of course, complicated the subsequent phenomena. The patient described the sensation while under the influence of camphor as "most exhilarating, but gradually becoming oppressive."

The contrast between the phenomena of these cases and the cases of the first series is very striking. When the medicine was taken in small doses frequently repeated, and during several hours, the effects were unequivocally stimulant, of an agreeable nature, and followed by little if any depression; but when nearly the same quantity of the drug was taken, and also in divided doses, but within a much shorter time, the stimulant effects were not only predominant, but so active as to be almost violent, and were im-

[1] Am. Journ. of Med. Sci., xi. 248.
[2] Month. Journ. of Med. Sci., Sept. 1846.

mediately followed by sedation and ataxic phenomena like those in the first series of cases.

There is still another case on record very closely resembling the one last narrated in its symptoms, but in which the whole dose of the medicine, *two scruples*, was taken at a single dose, and fasting. Purkinjé is its reporter.[1] The first effect of the medicine was to excite such a restlessness that the experimenter could not remain in bed. There was then a singular sense of lightness in the limbs. Sensibility to outward impressions seemed rather blunted. The attention could not be fixed. Ideas flowed through the mind in a swift and crowded stream, and the sense of personal identity was lost. These symptoms were temporarily relieved by vomiting, and for an hour the mind was applied to business. But the sense of sight was feeble and uncertain, while that of hearing retained impressions. At last consciousness was lost, and a copious warm perspiration broke out. The experimenter had an injected countenance, and experienced some convulsive movements, and lay for half an hour breathing slowly. After awaking, he was for a long time unable to recognize the familiar persons and objects around him, but he experienced no exhaustion.

When an attempt is made to determine the action of *medicinal doses* of camphor upon the healthy system, a twofold difficulty presents itself; small doses have seldom been submitted to scrupulous experiment for the object in question, and the results of clinical observation cannot, in general, be legitimately invoked to demonstrate or even to illustrate the physiological mode of action of a medicine. Yet if the effects produced upon the sick should uniformly correspond with those produced by like doses upon healthy subjects, the mode of action deduced from the latter class of facts is rendered still more probable by inferences from the former.

The first series of experiments to be adduced is that instituted by Jörg.[2] To begin with the smallest dose, this observer employed a solution of one grain of camphor in eight drops of alcohol, of which the least quantity given was four drops; this same number was added on every repetition of the dose, until three and a half grains of camphor were given at once. In a second series, the first dose was four grains, and the last twelve grains. In a third, fourth, and fifth series the dose varied from one-half a grain to eight grains; and finally, in five concluding series the dose rose gradually from one-half a grain to five grains. The fractional doses are not reported to have exerted any distinct influence, but a single grain did, in several instances, give rise to distinct phenomena which shadowed forth the more perfect effects of the larger doses. Not to dwell upon these in detail, it suffices to present the general conclusions to which the entire series of observations led. Jörg states them to be as follows: Camphor acts as a stimulant to the brain and intestinal canal, besides exciting the urinary and genital organs, the skin, and the vascular system. Hence it is indicated

[1] RICHTER, op. cit., Suppl. Bd., p. 442. [2] Materialien, etc., p. 230 et seq.

in diseases whose predominant symptom is debility, particularly where this state is maintained by atony of the intestinal canal. The opinion that camphor acts as a sedative on the organs of generation, and that therefore it is directly indicated in morbid excitement of these organs, is regarded by Jörg as belonging probably to the fabulous period of medicine. The reader will have seen that this is the appropriate action of the medicine in doses of thirty grains and upwards. Further proof, if necessary, might be adduced. Alibert cites the case of a nymphomaniac patient whom he cured by a drachm of camphor, and Esquirol successfully treated hysterical nymphomaniacs with the same remedy.[1] But these facts do not conflict with those of Jörg, and others, which prove that camphor in small doses is an excitant of the generative organs.

According to Sundelin,[2] camphor in small doses raises the pulse, rendering it both fuller and more frequent, diffuses a sense of warmth from the stomach throughout the whole body, and augments the secernent action of the skin. This author seems clearly to have apprehended the conditions under which the apparently opposite actions of the drug are manifested, and which it is a main object of this discussion to illustrate. "Small doses," he remarks, "demonstrate its stimulating qualities clearly; but as the quantity administered is greater, a condition is developed which at first sight seems to be the very opposite of excitement," and which the author attributes to congestion of the brain.

Purkinjé,[3] after taking a dose of *twelve grains*, in bed and fasting, experienced heartburn, a pleasant and moist warmth over the whole body, a general and agreeable excitement of the nervous system which was particularly distinct in the skin and muscles, a peculiar excitement of the brain, and above all a feeling of inebriation. These symptoms continued for an hour and a half, and were dissipated by the customary occupations of the day. They were not followed by any sense of lassitude.

Scudery[4] found that in a few minutes after taking from *ten to fifteen grains* of camphor the pulse grew more frequent and tense, the cheeks became red, the skin dry, the head ached, the eyes were bright and sensitive to the light, and the genital organs were excited. The same results were obtained on five successive trials, and were confirmed by those of Pasquali and Mezzotti. Scudery afterwards took *a scruple* of camphor dissolved in an ounce of alcohol, and experienced the same kind of symptoms, but a much higher degree of excitement. The same experimenter took *two scruples* of camphor, and in a few minutes afterwards two drachms of nitre dissolved in water. At first the pulse fell, and there were nausea and chilliness, but in half an hour it rose again, and there was fulness of the head, with redness and heat of the face. Another dose of nitre like the first was then taken, which produced nausea, and at the same time dispelled the other symptoms. In the last of

[1] Am. Journ. of Med. Sci., Jan. 1844, p. 190.
[2] Heilmittellehre, ii. 139.
[3] RICHTER, op. cit., Suppl. Bd., p. 442.
[4] Journ. des Progrès, xvii. 78.

these experiments the sedation is attributed to the nitre alone, but was doubtless owing in part also to the large dose of camphor. If we turn from the results of positive experiment to the opinions of competent observers, this is what we shall find:—

According to Sachs and Dulk,[1] camphor in medicinal doses excites the general sensibility, but in a particular manner the sensibility of the vascular system, and Murray declares that it is evidently stimulant. Vogt is of opinion that if we add the results of physiological experiment to those of clinical observation, no doubt can remain of the stimulant qualities of camphor. He thinks, indeed, that no other stimulant of the same class is comparable with it, and that in the extremest state of debility camphor is sometimes successful when all other medicines are fruitlessly employed. Camphor, says Richter,[2] evidently belongs to the class of oleo-ethereal medicines, and like these acts as a powerful stimulant. "It is by far the strongest and most searching medicine of its class, from all the rest of which it is distinguished by its rapid, durable, and widespread action on the nervous system. When the powers of life are low, and the skin is moistened with a cold sweat, it is often the most efficient of remedies." Oesterlen, and also Neumann, contend for the excitant properties of camphor. The latter declares it to be diaphoretic and antispasmodic, and that, in fine, it is one of the most thorough and active of stimulants. Mitscherlich infers from a review of numerous recorded experiments, that the sedation produced by very large doses of camphor depends upon its local action within the stomach, while the subsequent excitation is due to the absorption and circulation of the particles. Pereira affirms that in moderate doses it exhilarates and acts as a vascular excitant. Dr. Chapman is of opinion that "few medicines more unequivocally display their stimulant powers;" and Eberle[3] states that he has several times taken scruple doses of camphor, and found the pulse slightly increased in fulness, while he experienced giddiness and fulness about the head.

The following appear to be legitimate deductions from the whole of the inquiry which has now been made into the action of camphor on the healthy organism:—

1. The direct and primary action of large doses of camphor (gr. xx to gr. lx) is a powerful but not a permanent *sedation* of the nervous and vascular systems, followed by ataxic phenomena, and remotely by slight and very transient febrile excitement.[4]

2. The direct and primary action of small or medicinal doses (gr. j to gr. xv) of camphor is to *stimulate* and *excite* the nervous and vascular systems, and through them the whole organism; but the excitement is of short duration, and is not followed by exhaustion or depression.

[1] Handwörterbuch, i. 674. [2] Op. cit., iii. 364.
[3] Materia Medica, etc., p. 345.
[4] We are at a loss to account for the conclusion of Dr. Harley, that camphor "in all medicinal doses from the lowest to the highest certainly does not exercise a depressant effect on the circulation" (*Practitioner*, ix. 222), unless doses above twenty grains are excluded from the estimate.

3. The influence of camphor upon the sexual organs is subordinate to its aforementioned modes of action.

4. The transient operation of this substance explains the high grade of excitement produced by small doses repeated in close succession.

The sedation by large, and the stimulation by small doses of camphor, together with the transient duration of its action, resemble the effects of ether and chloroform more nearly than those of any other medicine, and the analogy is more complete if we have regard to the anodyne qualities of camphor for which it has at all times been chiefly used. Its control over pain never amounts, however, to the production of anæsthesia, unless we accept as proof of the fact the experiments of Fonssagrives,[1] in which he produced complete insensibility to pain in animals by causing them to inhale air highly charged with the vapors of camphor. Some doubt, however, attaches to the interpretation of these experiments; for the apparent narcotism of the animals may have been due to a partial asphyxia. It will be seen in the sequel that the ordinary remedial effects of camphor can only be explained by admitting it to possess a stimulant power. Of all these effects the two most prominent and demonstrable are its control over *asthenia* and *ataxia*. The latter, when connected, as indeed it generally is, with prostration of the powers of life, is as real, if not as clear, a sign of debility as the purer form of this condition which is attended with, or which tends to, resolution of all the functions, and the medicine which raises the system out of its prostration and disorder is well entitled to be called a stimulant. This state is not inaptly illustrated by the familiar phenomena of delirium tremens, a disease in which there is excessive muscular and nervous action, and which apparently is one of equally excessive power. Yet the appearance of energy in its symptoms is deceptive, for, with all his violence, the patient is actually weak; he has a feeble pulse, and sinks at once under debilitating treatment. His tumultuous symptoms are, on the contrary, reduced to order most certainly and speedily by direct diffusible stimulants, the best of which is alcohol, and next to it opium. Even the very substance under consideration has long ago been vaunted as efficacious in the treatment of this disease.[2] If, therefore, there is reason to class camphor among sedative medicines on account of its effects in this and analogous conditions, alcohol must with no less propriety be placed there also. In truth, ataxia is usually connected with debility, and the agent which relieves it does so by imparting strength and tone to the disordered and weakened system, and is of right called a stimulant.

Remedial Employment.—If such difficulties as have been pointed out arise in determining the normal operation of camphor, the labor of surmounting them is nevertheless but light when compared with that of clearing up the inharmonious and contradictory

[1] Archives Gén., 5ème sér., ix. 561.
[2] GOEDEN, On Delirium Tremens. Berlin, 1826.

statements which have been made respecting the remedial operation of this substance. The greater number of physicians appear to have employed it in accordance with a hypothetical notion of its operation rather than according to the conclusions of experience, and so generally to have combined other medicines with it in prescription, as manifestly to render its alleged effects the expression of a prejudice, or else a compound result of which it is impossible to assign a proper share to the substance in question. Could we ascertain precisely how far camphor has contributed to the mitigation or cure of diseases, the nature of the diseased states it is fitted to remove, and in what doses it effects its purpose, the art of therapeutics would be perfected much more than by the most ingenious discussions concerning the manner in which it brings about these results.

Adynamic and Ataxic Fevers.—Of all the diseases in which the use of camphor has been found beneficial by the most eminent physicians, none stands so prominently forward as the class referred to; and if any other reasons than have been already adduced were required to demonstrate the stimulant qualities of the medicine, this agreement of testimony in regard to the point in question would be conclusive. One of the earliest authorities on the subject is Diemerbroeck,[1] who classes it along with the aromatics useful in the plague, and represents Mindererus as declaring it to be one of the most powerful of alexipharmics in this disease. Huxham, too, expresses himself thus:[2] "I think that in these putrid pestilential fevers nothing more certainly promotes diaphoresis than camphor, with this further advantage, that it by no means heats so much as volatile alkaline salts. It is, besides, vastly serviceable in quieting the erethism and bringing on composure of spirits when opiates fail. Indeed, when joined with an opiate, it is the most certain sudorific in nature." Pringle[3] appears to recommend camphor chiefly for the purpose of regulating disordered nervous action, for he sometimes directs it in conjunction with serpentaria and sometimes with nitre. Hildebrandt[4] regards camphor as the most effectual remedy in the nervous stage of typhus, by means of its powerful action on the debilitated vital forces, the nervous system in general, and the skin.

The stimulant character of this medicine may further be inferred from the opinions of several eminent authors of its use in *malignant fevers.* The emphatic sentence of Ettmüller is, "*Remedium in febribus malignis sine camphorâ est instar militis sine gladio.*" Of the same purport is Haller's description of a variolous epidemic in which all other medicines failed and the mortality became general, when this physician resorted to camphor. He prescribed it in divided doses of about fifteen grains a day, given in solution; and under its use the hemorrhagic spots disappeared, as well as the alarming symptoms that accompanied them. Hoffmann[5] also speaks in like terms of the remedy, and employs this emphatic

[1] De Peste, lib. iii. cap. v.
[2] Essay on Fevers, p. 120.
[3] Diseases of the Army, pp. 135 and 267.
[4] Du Typhus, etc., Trad. de Gasc., p. 208.
[5] Op. cit., § xii.

language: "We are of opinion that nature has produced no one substance more prompt and powerful in removing the malignant elements of disease; hence it deserves, and has a right, to be called the prince of alexipharmics." Richter asserts very precisely[1] that, "in general, it is useful in the last stages of such typhoid affections as were inflammatory at the outset, whenever it is important to maintain the activity of the skin and nervous system, to overcome their depression when the exhausted vascular system is unable to bring about critical discharges, and when, especially, irritability and sensibility are both unduly depressed. The signs of this condition are a small, weak, tremulous pulse, muscular debility, quiet delirium, floccitation, subsultus, a cool, dry, parchment-like skin, or a cold, sluggish, and moist integument." Joseph Frank enumerates[2] debility, softness, and diffluence of the pulse, without irregularity, coldness of the extremities, which are covered with a viscid perspiration, a livid countenance, and dark ecchymoses of the skin, as indications for the use of this remedy. Sachs, Sundelin, and Strumpf do but repeat the detail of symptoms above given as calling for the use of camphor, and Neumann only subjoins the necessity of combining an external with the internal use of the remedy when signs of gangrene display themselves, adding that under these circumstances camphor is the only remedy on which reliance can be placed. Burne[3] recommends it along with carbonate of ammonia and alcoholic stimulants when the temperature of the surface is below the natural standard, the belly tympanitic, and the powers of life at a low ebb. In his excellent history of the typhus epidemic which he observed at the Philadelphia Hospital in 1836, and which the present writer had also the opportunity of studying, Dr. Gerhard observes: "Camphor was certainly among the most useful and powerful of our remedies. We used it largely in the severe cases, especially those in which the ataxic nervous symptoms were very marked, and we had no reason to repent of its employment. In general, there was a marked diminution of some of the most prominent and harassing symptoms. We gave the camphor in emulsion in doses of five grains every two hours, and in enema in doses of a scruple. The immediate effect was the lessening of the subsultus and tremors, for which it was chiefly administered, and sometimes the diminution of delirium. In some cases we possessed a complete control over the subsultus, which was immediately checked by an injection containing a scruple of camphor. It would cease for some hours, but afterwards return with nearly its former severity. Still, camphor was a useful palliative, and, like most remedies of its class, acted as a useful balance-wheel in preserving the harmony of the system until the disease had passed through its natural course. The camphor frequently acted powerfully as an anodyne, when sleep had been interrupted by the previous disturbance of the nervous system."

[1] Op. cit., iii. 368. [2] Pathol. Méd., i. 250.
[3] A Pract. Treatise on the Typhus, etc., p. 196.

Not to add unduly to the amount of testimony now produced, it need only be further remarked, that all of the authors who have had an opportunity of observing the operation of camphor in the treatment of low forms of continued fever, concur in recommending it as one of the most effectual means of combating adynamic and ataxic symptoms. Its control over the latter no doubt induced an erroneous estimate of its mode of action. When the power of the remedy to allay disordered action of the muscular and nervous system became apparent, it was, by some writers, inconsiderately inferred to possess intrinsic sedative qualities. The circumstance was too often overlooked by them, that the disorder in question was the consequence of impaired strength. Such a condition could only be relieved by stimulants, by medicines having the power of raising the depressed system to its natural level, and when this was once accomplished, either by camphor or diffusible stimulants, the agitation was appeased.

Inflammatory Disease.—Several of the writers who contend for the sedative properties of camphor, appeal to the authority of Hoffmann and other eminent physicians in support of their doctrine. But when the testimony of these witnesses is carefully sifted, it does nothing less than sustain the dogma in favor of which it is invoked. Without entering upon a critical and detailed examination of these alleged evidences, a single one may be adduced to illustrate their character. Hoffmann, for example, is quoted as contending for the usefulness of camphor in pleurisy, phrenitis, metritis, etc.; but this author expressly insists upon the union of nitre with camphor in these affections, regarding the combination as diaphoretic and sedative; and he emphatically states in the very same paragraph,[1] that he could not easily be persuaded to administer this substance alone, in inflammations of a high grade (*quibus maximus æstus junctus est*). But by the union of the two remedies, he conceived that while the one opened the pores, and the peccant humors (materia vitiosa) were expelled by the other, a combination was obtained capable of producing a salutary crisis in the disease. A not dissimilar union exists in the well-known Dover's powder, which is, indeed, also used for the very purpose which Hoffmann had in view.

If other writers of authority counsel the use of camphor in the phlegmasiæ, their advice is carefully limited by an explanation of the peculiar conditions in which they conceive the medicine to be useful. It is when, as so often happens, and, for example, during epidemics, inflammatory diseases assume a typhoid type. Under no other conditions whatever, of these diseases, is there any reliable evidence of the utility of the medicine in small or ordinary doses. The affections which are generally alleged to have been rapidly subdued by its use, are *pleurisy*, *pneumonia*, etc. But with the knowledge now possessed of these diseases, it is certain that the statements are groundless which attribute to camphor the power

[1] Op. cit., § xvii.

of curing them. The only exceptions to this judgment, are certain examples of acute pulmonary and other inflammations which seem indeed to have owed their speedy cure to the remedy under examination; but when the quantity of it employed is taken into consideration, the apparent discrepancy disappears; for it was no longer given in small or stimulant doses, but from forty to sixty grains of it were administered in the twenty-four hours.[1] In such doses the sedative action of the medicine became developed.

Chronic Inflammation.—According to Richter camphor is useful in *chronic rheumatism*, especially when the nervous element of the disease is prominent, and when the affection is erratic, or threatens the internal organs. He directs it to be given in large doses, such as one or two drachms in the twenty-four hours. In *gout*, also, when the same element predominates, and towards the close of the attack, Richter considers this medicine peculiarly adapted to perfect the cure. He also recommends it in combination with opium, as an effectual sudorific. In fact, this formula is well suited to fill the same place in the treatment of asthenic affections which the Dover's powder holds in that of purely inflammatory diseases.

Spasmodic Affections.—Several authors ascribe a curative power to camphor, in *whooping-cough*, obstinate *hiccup*, *chorea*, and even *epilepsy*. Sundelin states it to be useful in the two last named affections when they arise from the suppression of cutaneous eruptions, or from the metastasis of rheumatism. Berends recommends it in those cases of epilepsy in which the paroxysms occur at night, and directs one or two grains to be taken at bedtime. The efficacy of such a prescription may very well be doubted. Other affections, such as *nervous headache*, nervous *palpitation of the heart*, *spasmodic dysphagia* affecting susceptible persons, are stated by several authors to be amenable to camphor. But in this class of disorders, the original and principal affection on which the minor ones depend must not be lost sight of, for against this main source of the morbid phenomena, camphor may prove ineffectual. When the affection is inflammatory in its nature, the medicine, as Mitscherlich observes, is more hurtful than useful, unless, indeed, the erethism have its starting-point in the sexual organs. Camphor has been used to advantage as *an antidote to strychnia*. In several cases reported by Dr. Arnett[2] and Dr. Pritchard,[3] it acted with such promptness when the symptoms were most violent as to leave no doubt of its efficacy.

Affections of the Sexual Organs.—In *satyriaris*, *furor uterinus*, and *hysteria libidinosa*, camphor is, according to Richter, a capital remedy. "If no inflammatory symptoms exist, or if these have been allayed by depletion, the medicine ought to be given in heroic doses, or, if there be vascular excitement at the same time, it should be conjoined with nitre. In one case it was successfully given in drachm doses four times a day. Müller cured an irrepressible

[1] *E. g.*, GIACOMINI, loc. cit.
[2] Charleston Med. Journ., xii. 86.
[3] Lancet, April, 1857, p. 422.

venereal desire and excessive priapism in a clergyman, by prescribing camphor in ascending doses, until a drachm was taken daily. Richter successfully employed large doses of the medicine for a patient affected with sleep-walking and priapism, and who had formerly been addicted to onanism, and experienced convulsive attacks under the excitement of sexual lust. When persons who cannot be weaned from the habit of self-pollution are threatened with spasmodic attacks, or with the consumptive wasting peculiar to such cases, camphor should be administered, and not in too small doses. If, however, its use be too long persisted in, there is danger of emasculating the patient."[1] Schneider speaks of a stout and healthy youth of nineteen, who had been piously and virtuously brought up, but who became suddenly enamored of his stepmother, and whose lust grew so furious that his testicles swelled, and the flow of semen interfered with his urination. He was soon completely cured by the internal and external use of camphor.[2] Alibert relates the case of a woman, twenty-eight years of age, who thoroughly subdued a violent paroxysm of sexual passion by taking a drachm of camphor. On two previous occasions she had used the medicine with equal success. The following example of the same effect is presented by Eberle.[3] "I was consulted by an elderly married man, of rigidly moral habits. He informed me that he suffered very much from painful erections, and an incessant propensity to venery. He was naturally of a gloomy disposition, which was much increased by his complaint. I ordered him camphor, in two grain doses, to be taken three times a day. In a week he returned and told me he was almost entirely relieved; and by a further continuance with the remedy he was completely rid of his tormenting complaint." According to Vogt, camphor displays a peculiar efficacy in the erythematous irritation of the genito-urinary organs which cantharides provoke, and which has a strong tendency to run into gangrene. It is perhaps mischievous in pure sthenic inflammation of the same parts; but Latham has reported several cases of its efficacy in relieving retention of urine produced by an exacerbation of chronic disease of the neck of the bladder, and one in which this symptom was produced by cold. He found frictions of the thighs with a camphorated liniment the most efficient method of using the remedy.[4]

On the whole, the cases adduced under this head confirm the conclusion already arrived at by physiological experiment, and show that large doses of camphor are sedative to the morbid as well as to the normal action of the sexual apparatus. One or two cases, it is true, seem to prove that this power may be exerted even by ordinary medicinal doses. They might, perhaps, be explained in accordance with the general doctrine; but not to appear unduly solicitous to harmonize completely phenomena which are not thoroughly known, the cases referred to may for the present be arranged in that vast class of medical facts, the exceptional.

[1] Op. cit., iii. 372.
[2] Ibid., Suppl. Bd., 444.
[3] Thérap., p. 349.
[4] Med. Communications, ii. 138.

Mental Disorders.—According to Murray,[1] camphor has been used in *mania* and *melancholy* since the time of Paracelsus. Ettmüller, Sennert, Kinneir, Werlhof, Berger, Rosenstein, and Whytt are quoted among others by the same author as having successfully treated insanity by this medicine. Their cases generally belonged to the maniacal form of the disease, and large doses of the medicine (gr. xx to gr. lx) were administered. In some instances it proved injurious by exciting patients who were previously quiet, or by rendering the maniacal still more violent. Murray puts no faith in the symptoms relied upon by Auenbrugger as indications for the use of camphor, and which are summarily these: A shrivelled state of the genitals, retracted testicles, and comparative coldness of these parts. Other observers have been equally unsuccessful in meeting with these signs. Cullen relates a case of furious mania, in which, after largely employing antiphlogistics, he prescribed camphor, at first in doses of five grains three times a day, but which were subsequently increased. No perceptible change was observed until two scruples were taken at each dose, when the patient grew calmer. At last the medicine was given in drachm doses, and the attack was entirely cured. Cullen, however, did not find it equally successful in other instances. Reil holds camphor to be particularly indicated when the countenance is pale, the extremities cold, the breathing sluggish, and the pulse slow; and he directs it to be given in five grain doses four times a day until a scruple is taken at each dose. He thinks, however, that it too often disappoints.[2] Berndt has recommended it in large doses for *puerperal mania*, having found it successful after a fruitless employment of antiphlogistics, of ether, and of stimulants. He prescribed it in large doses. Since the introduction by Pinel of moral influences into the treatment of insanity, less attention has been given to the purely medicinal remedies which were earlier in vogue, and little can be drawn from the vast stores of recently published experience to illustrate the present subject. When used at all amongst the insane by practitioners of the present day, it has been to palliate nervous agitation, and thus indirectly to induce sleep.

Camphor has been extensively employed as an *anthelmintic*. Brera, one of the highest authorities on the subject, says: "I have always used it with the greatest success, and I cannot too strongly recommend its use to physicians in worm complaints."[3] Moscati, indeed, gives it the preference over all other vermifuges. It is thought to be not less efficacious when administered by the rectum than by the mouth, for its effluvium readily pervades the whole intestinal canal. The former is the preferable mode of prescribing it against *ascarides*.

In *gangræna senilis* camphor has some reputation. Sachs relates a case in which the disease was arrested by five-grain doses given every two hours, and many other writers offer similar testimony.

[1] Apparat. Med., iii. 499. [2] RICHTER, op. cit., iii. 376.
[3] On Verminous Diseases, trans. by Coffin, p. 199.

Several recommend the simultaneous application of finely-powdered camphor to the affected parts. Warlomont reports a case of its prompt curative virtues in *hospital gangrene*.[1] Richter speaks of this medicine as one of the most effectual amongst diffusible stimulants in *narcotic poisoning*, and a like opinion was entertained by Lassone, Halle, and Murray. Camphor is also very generally employed to *prevent strangury* from blisters of cantharides, by mixing it with the ointment of the latter when it is applied, or moistening the surface of the blister with the tincture, and also to subdue this symptom after it has arisen. The production of strangury by blisters is, however, so uncertain that the prophylactic power of camphor, under the circumstances alluded to, may fairly be questioned. But that it greatly relieves this painful symptom, when it is administered internally and in large doses, is proved by abundant and incontestable evidence. It is almost equally certain that it prevents or moderates *priapism* in *gonorrhœa*, for those who have had the largest experience in the treatment of veneral affections testify most positively to the fact.

External Uses.—Camphor is employed in almost all external painful affections. Its use in *gangrene* has already been alluded to. It is not less useful in *scorbutic* and *herpetic sores*, and, in fact, all sorts of ulcers that are maintained by a depressed or depraved condition of the system. In such cases the medicine should be applied in substance, and in a very fine powder. Champouillon claims that all sorts of chancres are benefited by a dressing of finely powdered camphor repeated twice a day, but those especially which are situated behind the corona or on the internal surface of the prepuce. The powder should not be renewed at each dressing except where it has become detached.[2] When the skin around wounds and abrasions assumes an *erysipelatous* action, no remedy is more prompt than bathing the part with spirit of camphor. The *suggillations* caused by surgical apparatus, or by the pressure of the bed when patients are obliged to maintain the same position for a long time, *ecchymoses* from violence, and almost every variety of painful swelling, including particularly such as are caused by *sprains*, are everywhere treated by camphor dissolved in oil or in alcohol, applied either by friction or by means of compresses saturated with the latter solution. It is not less frequently resorted to as an embrocation in *chronic rheumatism* and in *glandular swellings*. Still more efficient, because more permanent in its operation, is a cataplasm the surface of which has been covered with camphorated oil, to which may be added ointment of stramonium, or the extract of belladonna or of opium. In such cases the camphorated mercurial plaster is often very servicable. Spirit of camphor is very successfully employed to suspend the *secretion of milk* after parturition, and the oily solution may be applied by friction to disperse the mammary engorgements incident to this period. Camphor dissolved in ether or chloroform, or even in alcohol, and applied on cotton

[1] Bull. de Thérap. lxxxii. 93.

[2] Bull. de Thérap., lxxvi. 526.

within the cavity of carious teeth, mitigates materially the pain of *toothache*. It is also used externally to relieve *chordee*. Twenty or thirty grains are sprinkled upon a poultice, which is applied to the perineum. Snuffing the emanations from a piece of camphor is said to arrest commencing *coryza*. It is advantageously incorporated in ointments and in other applications made to cutaneous affections when there is painful itching or burning of the affected part. Maury asserts that a camphorated liniment composed of one drachm of camphor to an ounce of oil is a most excellent remedy for the cure of *scabies*,[1] and Mr. Wilson[2] says: "In young children and in families, when the odor of sulphur is made a point of serious objection, I have found camphor dissolved in oil answer every purpose of eradicating the disease." Locally applied the same solution, and also powdered camphor, are said to prevent the maturation of *variolous pustules*.

Contraindications.—Active congestion and sthenic inflammation, of whatever organ, forbid the use of camphor, but especially when the brain or the stomach is the seat of the morbid condition or process.

Administration, etc.—Camphor may be given in substance, after being pulverized with a little alcohol, but the emulsion is preferable. This is made by rubbing up camphor with loaf-sugar, gum-Arabic, and water; the suspension will be rendered more complete and permanent by the addition of a little myrrh. Camphor-water is too feeble a preparation except for very slight ailments, such as nervous and hysterical excitability; and the tincture, except in small doses, is too stimulating to the circulation. The last-named and various other solutions of camphor in alcohol and oil are used almost exclusively as external applications.

To obtain the *stimulant* effects of camphor, it must be given in doses of from *two* to *five* grains, at intervals of from one to three hours; or, if the prostration and derangement of the nervous system are marked, from *ten* to *fifteen* grains may be administered every three, four, or five hours. But the *sedative* action of this substance, which is so valuable in cases of high nervous excitement, can only be procured by doses of twenty grains and upwards. The last-named quantity will rarely suffice, and the dose must be gradually increased until some decided mitigation or exasperation of the symptoms shows that the object is attained, or is unattainable by this medicine.

In cases of poisoning by camphor the appropriate remedy, and that which has been found efficient in many cases, is alcohol. It should be given in the form of wine or of distilled liquor in small and frequently repeated doses.

BROMIDE OF CAMPHOR.—Bromine unites with camphor so as to form monobromized camphor, which differs from ordinary camphor by the substitution of an atom of bromine for an atom of hydrogen. It is crystallizable, and decomposes readily on exposure to the at-

[1] EBERLE, loc. cit. [2] Diseases of the Skin, p. 247.

mosphere. According to Deneffe it is an excellent "sedative" of the nervous system, an opinion founded upon its advantages observed in delirium tremens. The fact of course proves it to be a stimulant of the nervous system, and a sedative only of its disordered action. Dr. Hammond[1] used it successfully in the *convulsions* of dentition, in nervous *headache*, and especially in a very obstinate case of *hysteria*, in which paroxysms of weeping and laughing alternated with epileptiform and choreiform convulsions. In this case the medicine was given in the dose of four grains every hour; after the second dose the symptoms began to decline, but ten were necessary to break up the attack. The *dose* for an adult is from two to five grains. It may be given in pill or in emulsion.

ÆTHER.—Ether.

ÆTHER FORTIOR.—Stronger Ether.

Description.—Ether is prepared by distilling alcohol with sulphuric acid. Alcohol is the hydrated oxide of ethyle, and, on the addition to it of sulphuric acid, which has a strong affinity for water, it parts with this element, and an impure oxide of ethyle is obtained. This is purified by redistillation with a solution of potassa for the removal of sulphurous acid, and by agitation with water for the extraction of alcohol. Stronger ether is prepared by agitating washed ether with chloride of calcium and lime, decanting the ether, and distilling half the original quantity. Ether is a clear, colorless liquid, of the sp. gr. 0.750. The sp. gr. of stronger ether is 0.728. It boils below 105° F., and the specific gravity of its vapor is 2.565. It has a strong, penetrating, and at first not unpleasant smell. Its taste is hot, like that of alcohol, but is more acrid. It is very volatile, and by its evaporation will reduce to zero (Fahr.) the mercury of a thermometer, the bulb of which is kept moistened by it. It is also very inflammable, and its vapor, mixed with air, is explosive; hence great care should be taken in using it near an artificial light.

History.—The writings of Raymond Lulli contain perhaps the earliest account of a liquid obtained by the reaction of sulphuric acid with alcohol; but the word *ether*, which was subsequently used to designate every penetrating vaporizable substance, including highly rectified alcohol, is not mentioned there. Basil Valentine described its mode of preparation and physical qualities, which were more fully set forth by Valerius Cordus (1544), Boyle, Willis, and others. It seems to have been first called (*spiritus æthereus*) by Froben, a German chemist, in 1730. V. Cordus extolled his *oleum vitrioli dulce*, given in doses of a few drops on sugar or with water, as a remedy in the plague, and for various spasmodic symptoms, for moderating expectoration in pulmonary complaints, and for

[1] New York Med. Journ., xv. 522.

alleviating the pains of biliary, renal, and vesical calculi. From the time of Hoffmann it came into general use as a remedy, or at least a palliative, in various spasmodic and painful diseases, and a well-known mixture of ether and alcohol still bears the name of Hoffmann's anodyne. The introduction of ether as an anæsthetic agent will be noticed in a separate article.

Action. *On Plants and Insects.*—Plants exposed to the contact of ether, or its vapor, grow darker in color, and if the exposure be long continued, and in a confined space—as under a bell-glass, for example—they turn brown, and the irritability of their stamens is lost. According to Heyden, insects are rapidly benumbed by ethereal vapor, without changing their appearance. Beetles are immediately killed by it.[1] Butterflies exposed to its emanations, and apparently destroyed by them, will sometimes revive after the lapse of several hours, and seem to regain their original vigor.

On Quadrupeds.—In moderate quantities, ether excites in warm-blooded animals at first a lively and fugitive animation, and an excitement of the circulation like that produced by alcohol, and subsequently oppressed breathing, disturbance of the nervous system, and complete insensibility, which passes away without further mischief; but if the dose be increased, the last-named symptom merges into asphyxia, and sooner or later into paralysis and death. On dissection of animals that have perished from this cause, an ethereal odor may be detected in the abdominal and thoracic cavities.

Orfila introduced about half an ounce of ether into a dog's stomach, and tied the œsophagus. In five minutes the animal was seized with vertigo, and soon lost his power of standing. There was no convulsion, and the senses seemed perfect. At the expiration of fifteen minutes the dog became insensible, and his limbs grew flaccid. In an hour he had partially recovered, but continued to reel and totter in walking. Soon afterwards he again fell down, and remained insensible for two hours, when he died. The gastric mucous membrane was found, on dissection, of a dark red color, and the other coats were vividly injected. Black and partially coagulated blood filled the heart, and the lungs were gorged with liquid blood.[2] The experiments of Mitscherlich gave analogous results. A drachm of ether was thrown into the stomach of a large rabbit. The animal became almost immediately insensible, breathed laboriously, and could not stand upright. It died, without spasm, in fourteen minutes. The muscular contractility of the intestines was found to be feeble. The mucous membrane of the stomach and small intestine was very much inflamed. When from four to eight fluidrachms of ether were employed in the experiment, the animal perished in less than five minutes from distension of the abdomen and suffocation.[3] According to Brodie's experiments, five or six fluidrachms administered to a horse produced a state of lethargy, and completely destroyed irritability.

[1] STRUMPF, op. cit., i. 996.
[2] Toxicologie, ii. 688.
[3] Lehrbuch, ii. 348.

On Man.—Ether has a peculiar smell and a sweetish taste. It momentarily stimulates the olfactory nerves and the brain. When swallowed, it excites a sense of heat in the stomach, which seems to spread itself from thence over the whole abdomen. Applied to the skin, and allowed to evaporate, it does so very rapidly, and produces a marked degree of cold; but if it is maintained in contact with this surface, it soon occasions heat and redness. The same effects are produced by its application to mucous membranes, but with the addition that it is rapidly absorbed, and produces the phenomena which will be described under the head of *Etherization.*

Trousseau thus describes the effects upon himself of a drachm and a half of ether taken at a single dose: "There was a singular and sudden attack of suffocation, a feeling of such penetrating and intense cold and heat that the chaos of sensation defied analysis. It was very difficult to swallow the liquid, and as it descended the œsophagus a rather lively heat was felt in this tube and afterwards in the stomach. After the peculiar smell and taste of the fluid ceased to be perceived, the symptoms were like those caused by alcohol, but more superficial. The senses were indeed suddenly and actively excited, and a trifling vertigo was followed by such an obtuseness of the senses as might be produced by the intervention of a thin veil between their organs and external objects. To these symptoms may be added a slight muddiness of the eye, and an erratic and not unpleasant prickling of the extremities, which ceased in an hour, and was followed by a decided sense of comfort, a wholesome refreshment, and an extraordinary appetite."[1]

The phenomena described by other observers are essentially such as have been enumerated. Thus, according to Giacomini, when taken internally and in moderate doses, it gives rise to a sense of heat, in the mouth first, and then in the œsophagus and stomach, which is followed by an agreeable coolness in the throat. One seems to breathe more easily, the skin grows warm, red, and moist, the pulse stronger and fuller. The brain is sometimes slightly excited, the distension of the stomach causes oppression, which, however, is soon relieved by eructations. In larger doses, ether produces a species of intoxication, with numbness of the limbs, which soon passes off.[2] The system readily becomes accustomed to the impression of ether. Lafontaine states that a dropsical patient who had swallowed a bottleful of ether, and urinated profusely in consequence, took twenty-six ounces of this liquid in the course of three weeks, and finally got well. Christison mentions a man who for several years took nearly two ounces of it daily. Richter was in the habit of prescribing it in half-ounce doses, and Frank seldom gave less than an ounce a day.

Remedial Employment. *Nervous Disorders.*—In *tetanus*, when opium has been carried to the limits of prudence, its action may be maintained and heightened by ether. After the battle of Austerlitz it was very successful in arresting tetanic symptoms in the

[1] Op. cit., ii. 244.

[2] Op. cit., p. 58.

wounded. It is used in every form of *syncope* and apparent death to stimulate the vital powers, and is especially indicated in purely nervous swooning. It is hardly less so in fainting from loss of blood. *Nervous headache*, which generally shows itself as hemicrania or in the more limited form of supra-orbital neuralgia (brow ague), is often relieved very promptly by a small dose of ether, particularly when the attack depends upon depressing mental emotions. A flushed face and throbbing temples are not contraindications for its use. These signs of vascular excitement are fallacious, as is proved by the coldness of the hands and feet which generally accompanies them, and sometimes also by the feebleness and infrequency of the pulse at the wrist. Many cases of *flatulent colic*, *spasmodic vomiting*, *hiccup*, and even the paroxysms of *spasmodic asthma*, are promptly relieved by this medicine. These and other painful affections, including the so-called *hepatic* and *renal colics*, are more promptly and certainly assuaged by the inhalation of ether, as will be more fully described in the sequel.

But the most useful of all the applications of ether to the class of diseases under review is presented by *hysteria*, in certain of its phases which have been admirably pointed out by Trousseau.[1] The more superficial these affections are, and the more uncertain, recent, and sudden in their attacks, the stronger is the control of ether over them. Like the greater part of diseases *sine materiâ*, hysteria is undefined, irregular, and entirely destitute of that orderly development which distinguishes the phlegmasiæ, for example. Its characteristic is that, whether one, or two, or the whole train of its phenomena appear, the disease is essentially present. The accomplished observer divines its presence even from observing that the patient yawns and sobs or sighs without any definite or adequate reason; he detects it in the mere palpitations of the heart, with which the bosom of young girls seems to heave and swell; in a momentary dysphagia, which appears to be caused by a shifting meteorism of the abdomen, a flatulence that suddenly arises and seems to struggle for an escape from the throat; in a spasmodic hiccup, an agitation that seems involuntary, and which is accompanied with restlessness and deep sighs; in all of those symptoms which, when united and completely developed, constitute the *fit of hysteria*. These symptoms, and in proportion as they are recent and uncombined, yield as if by magic to ether. But even a high degree of them does not render ether inopportune. Again, in the male sex there are certain phenomena essentially of the same nature; such, for instance, are flatulence and palpitations of the heart. Some persons, too, of a nervous temperament, are liable to sudden and partial congestions, which are often observed to occur as the consequence of hemorrhage. These, which have already been referred to, are usually amenable to the influence of ether. Trousseau presents an illustration of the power of ether over the nervous element in a mixed nervous and inflammatory disease. A child

[1] Op. cit., ii. 245.

with croup had had the operation of tracheotomy performed, and was in an unusual state of agitation with frightful orthopnœa, yet a teaspoonful of syrup of ether from time to time procured rest and sleep for the little sufferer, and not once only, but on several successive occasions, until death came to its relief.

An interesting case is reported by Laffont, of *puerperal mania*, occurring in several successive confinements, and in each instance arrested by enemata of sulphuric ether.[1]

In Typhous Affections, etc.—Ether has been frequently employed in the several grades and varieties of *typhus*; and in these forms of disease there is indeed hardly any contraindication to its use, for it may be resorted to even when the typhous state is complicated with inflammation, with febrile eruptions, foulness of the primæ viæ, or functional nervous disorders. But, as its influence, however salutary, endures but for a brief period, it is rather to be regarded as providing an opportunity for administering remedies of more permanent influence, than as being curative in itself. Its ephemeral stimulation is also beneficially invoked on those occasions, which occur so frequently in typhoid affections, when some undue exertion, some excessive evacuation, or some other depressing cause, momentarily threatens to extinguish life. These qualities fit it, in a remarkable manner, to be associated with more permanent stimulants, and with tonics; by its means the latter medicines seem to gain stronger hold upon the system, and to exert their peculiar powers with more permanent effect. Trousseau[2] speaks of a somewhat similar employment of ether in cholera asphyxia. He administered it in doses of a dessertspoonful every hour, along with ice and some slightly stimulating drink—infusion of mint, for instance—and suspended its use whenever the pulse began to be felt at the wrist, and some warmth returned to the skin. This moderate degree of stimulation was, according to M. T., the cause of the gentle reaction which took place in his cases, and was sufficient for their cure; they were also untrammelled by the intercurrent inflammations of a bad type which destroyed so many persons in the same disease.

Systematic writers generally ascribe *anthelmintic* powers to ether, and refer particularly to the reports of Bourdier, who succeeded in relieving twelve out of fifteen persons afflicted with *tapeworm*. But a reference to his cases shows that a very trifling share of the result can be claimed for ether, since it was administered along with one of the most certain destroyers of the parasite in question, viz., male fern. M. Lortet, however, claims to have cured several cases of tænia by doses of ether large enough to render the parasite torpid, after which it was expelled by a full dose of castor oil.[3] The purgative should follow the dose of ether without much delay, in order to secure its expulsion before the worm has recovered from the benumbing operation of the ether. Fifteen or twenty drops of ether

[1] Bull. de Thérap., liv. 331.
[2] Op. cit., ii. 249.
[3] Bull. de Thérap., lxviii. 44.

in an ounce of water form a very efficient enema for destroying *ascarides in the rectum*. It will not, however, prevent their return.

About the close of the last century, equal parts of ether and oil of turpentine were recommended by Durande, of Dijon, as a specific for *biliary calculi*. On account of the offensive taste of the compound, Duparcque substituted castor oil for oil of turpentine, in a mixture which contained fifteen parts of the former to one of ether. Many and eminent physicians have attested the efficacy of both formulæ. Experiments with gall-stones show that these bodies are very slightly soluble in either of the above mixtures; indeed, so far as relates to sulphuric ether, it acts as a solvent only of the fatty portion of the calculus (cholesterin), even when this body is plunged in a bath of it. How far such a concretion would dissolve under the influence of the small proportion of ether which might reach it through the circulation, may be imagined.[1] Nevertheless, many cases of biliary calculus have been cured by one or the other of the above preparations of ether, probably more by relieving the pain and spasm which the irritation of gall-stones occasions,[2] than by the solvent operation of the remedy. The latter is, however, maintained to be real by M. Barth,[3] and his judgment is rendered all the more plausible in view of the results reported by Dr. Buckler as having been obtained with chloroform. An account of them will be found under the appropriate head.

Sulphuric ether has sometimes been employed as an *antidote* to *narcotic poisons*, and especially the poisonous *mushroom*. The Italian school of Rasori attached great importance to the powers of ether in cases of poisoning by narcotic and contro-stimulant substances in general, in which class they included digitalis, nux vomica, the salts of lead, mercury, antimony, and zinc, squill, etc. They alleged, also, that it arrests diarrhœa, caused by an abuse of purgatives of the drastic sort as well as the profuse sweats that are produced by excessive depletion and by sedative medicines, such as antimony, etc.

According to Claude Bernard ether has a marked influence in augmenting the flow of pancreatic juice, and Dr. Foster, assuming the fact to be correct, made use of ether along with cod-liver oil in pulmonary *phthisis*, hoping by this means to promote the assimilation of the oil and thereby improve the nutrition of the patients. It is claimed by him that experience justified his view of the value and mode of action of this combination.[4] But it does not appear that other observers have confirmed his results, and the exceedingly disagreeable taste of the preparation, as well as the eructations it occasions, soon render it intolerable to most persons.

External Uses.—Ether is very commonly employed, and with great advantage, as an external application either to expel the blood from an inflamed or swollen part, or to mitigate local pain. Some of the most familiar examples of its use are the following: It is

[1] Compare HENOCH, Unterleibskrankheiten, ii. 254; FAUCONNEAU-DUFRESNE, Mal. du Foie, p. 257.

[2] BUDD, Dis. of the Liver, p. 297.

[3] Abeille Méd., xi. 79.

[4] Brit. Med. Journ., Aug. 1868.

applied to the forehead on a very thin compress so as to favor its rapid and complete evaporation, for otherwise the skin becomes irritated by the liquid. This application is very frequently resorted to in attacks of *nervous headache*, of *neuralgia* of the frontal nerves, and in diseases attended with *delirium*, and undue heat of head. A similar application has been recommended in superficial *burns*. For the last two purposes mentioned it is, however, scarcely comparable to cold water, and its success in the other cases is probably due rather to the anæsthetic properties of the fluid than to the cold produced by its evaporation. In simple *neuralgia*, particularly of the nerves of the head, its anodyne may be usefully combined with its revulsive effects by applying it on small compresses covered with some solid substance, immediately over the points where the painful nerve emerges from its bony canal, or where it in any other way becomes superficial. These are always the points at which, as shown by Valleix, the morbid sensibility of the nerve is most easily detected.

The volatile and refrigerant quality of ether has been successfully employed to favor the reduction of *strangulated hernia*. As the strangulation depends, not upon the imaginary spasm which is generally invoked to explain it, for spasm in a tendinous structure is impossible, but upon the influx of fluids into the protruded bowel which is then unable to return into the abdomen, it is evident that whatever tends to contract the tissues of the hernial tumor will be favorable to its reduction. Ether does this when dropped upon the tumor and allowed to evaporate. It acts as ice would do, but with less risk of congealing the protruded bowel.

There is no more certain remedy for *toothache* when it affects a tooth occupied by a carious cavity, than filling the latter with cotton soaked in ether, or still better in an ethereal solution of camphor. Itard recommended ethereal vapor to be thrown into the auditory canal for the relief of *otalgia* and of *tinnitus aurium*,[1] a practice which was imitated, in 1841, by Mr. Neill, of Liverpool, who, however, administered the vapor by the Eustachian tube,[2] and by M. Délioux, in 1853, who employed the original method of Itard.[3] In some cases of *deafness* apparently depending upon rheumatism or following catarrhal affections of the auditory canal, instillations of ether appear to have been useful. Mackenzie speaks of ethereal vapors directed against the eyes in *amaurosis* from irritation or debility,[4] and we may add that we have found them of essential service in morbid sensibility of the retina produced by over-exertion of the eye. Inhalation of ether has long been employed as a remedy to recover persons from *fainting fits*, to palliate *hysterical attacks*, and subdue *nervous agitatation*. But it was also long ago recommended in more serious ailments. Pinel and Pearson both used it in *spasmodic croup*, and Currie in *asthma*. Pearson even asserted its usefulness in *consumption*, for he found it to diffuse

[1] Mal. de l'Oreille, ii. 25.
[2] On the Cure of Cataract, etc., 1848, p. 197.
[3] Bull. de Thérap., lxiv. 529.
[4] Dis. of the Eye, 1835, p. 962.

an agreeable coolness throughout the chest, to alleviate oppression and cough, to lessen expectoration and hectic fever, and even, he believed, to promote the cicatrization of tuberculous cavities. It might certainly be used to some extent as a substitute for the opiates it is customary to prescribe in phthisis, and which too often act mischievously by impairing the appetite and digestion.

Administration.—A fluidrachm is the average dose of ether. It may be given upon sugar, or a syrup may be formed by repeatedly agitating the excipient with ether, and removing the excess of the latter. It may also be incorporated in aqueous and other mixtures by being first rubbed with spermaceti, in the proportion of two grains of this subtance to a fluidrachm of ether.

SPIRITUS ÆTHERIS COMPOSITUS.—*Compound Spirit of Ether; Hoffmann's Anodyne.*

This liquid consists of ether, half a pint, alcohol, a pint, and ethereal oil six fluidrachms. The influence of the last-named ingredient of the preparation is probably to increase its sedative action on the nervous system. It is less volatile than ether, has a burning, yet agreeable taste, and the odor of ethereal oil. Its sp. gr. is 0.815. In its properties it bears a close resemblace to ether, but is more stimulating to the vascular system, and its action is more prolonged. It is also less apt to embarrass the digestive organs. It may be employed in all of the internal disorders for which ether has been recommended. In hysterical affections it is perhaps superior to that medicine. *Dose*, from half a fluidrachm to two fluidrachms.

ETHERIZATION.

History.—The discovery of the *anæsthetic*[1] properties of ether is certainly one of the most remarkable of the present age. Whether we consider the novelty of its claims, the speed with which its fame spread throughout the civilized world, or the extravagant anticipations that were formed of its powers, it stands without example in the history of medicine. Nor is it less singular that so brilliant and sudden an apparition should have been almost as suddenly eclipsed by a substance still more potent than itself, to the uses of which it pointed out the way. If the most valuable discoveries in the natural sciences, and above all in medicine, were usually the result of logical inferences from experience, a means of producing insensibility to pain would undoubtedly have been one of the first fruits of man's ingenuity and research. But such discoveries are very differently made. All, or nearly all of them, are the results of an apparently fortuitous concurrence of circumstances such as human wit alone could never have created. So in the present instance the accidental coöperation of a man of science and a professional artisan, appears to have been the immediate and essential condition for a discovery on the threshold of which investigators had been standing for more than half a century.

[1] This term was proposed by Dr. O. W. HOLMES, Nov. 21, 1846.

The power of various substances to produce insensibility was long ago observed, and it is well known that in all ages narcotic preparations were employed to blunt the sense of pain during the performance of surgical operations. The fumes of some of these were administered by inhalation. The late Dr. Snow, in his historical sketch of anæsthesia,[1] quotes a passage from the work of John Baptista Porta on Natural Magic, in which a certain volatile agent is thus described: "When it is applied to the nostrils of the sleeping person, he draws in the most subtle power of the vapor by smellings, and so blocks up the fortress of the senses that he is plunged into the most profound sleep, and cannot be roused without the greatest effort. After the sleep, no heaviness of the head remains." It is probable, as conjectured by Dr. Silvester,[2] and by Dr. Snow, that this agent was none other than ether.

In 1803, Dr. Benjamin Rush, referring to a case in which a woman gave birth to a child unconsciously during an epileptic fit, remarked: "How far a medicine so powerful (if such can be found) as wholly to suspend the sensibility of the nerves without impairing their irritability, might succeed in destroying pain altogether, I know not."[3] Subsequently he says more explicitly, "I have expressed a hope, in another place, that a medicine would be discovered that should suspend sensibility altogether, and leave irritability, or the powers of motion unimpaired, and thereby destroy labor-pains altogether."[4] In this passage we have a literal anticipation of the effects of ether in parturition.

The first traces of the use of ether inhalations for medicinal purposes seem to be contained in the writings of Dr. Richard Pearson, who, as early as 1795, recommended them for certain pulmonary affections, and especially for phthisis. He prescribed them either alone or combined with conium, and directed the vapor to be inspired from an open vessel, or through an inverted funnel, or from a handkerchief wetted with ether and held near the mouth and nose.[5] In Dr. Beddoes' work on "Factitious Airs, 1795–6," there is a letter from a patient of Dr. Thornton, describing the effects of the inhalation of ether employed for pulmonary catarrh. He says that it almost immediately relieved the oppression and pain in the chest. On a second trial he inhaled two teaspoonfuls of ether, which "gave immediate relief as before, and very soon after he fell asleep and had a good night's rest." In still another case, the fumes of burning ether were inhaled to palliate a painful affection of the breast.[6] In 1815, Nysten stated the inhalation of ether to be useful in certain chronic catarrhs with excessive secretion, for allaying convulsive cough, etc. He describes a bottle like the ordinary respirator, for the purpose of inhaling its vapor. In 1818, an anonymous communication appeared in the *Quarterly Journal of Science*, to the following effect: "When the vapor of

[1] Chloroform and other Anæsthetics. Lond. 1858, p. 12.
[2] Times and Gazette, Nov. 1857, p. 504. [3] Med. Repository, vi. 30.
[4] Med. Inq. and Observ., 5th ed., iv 221. [5] Med. Facts and Observ., vii. 95.
[6] Brit. and For. Med.-Chir. Rev., April, 1847, p. 549.

ether, mixed with common air, is inhaled, it produces effects very similar to those occasioned by nitrous oxide." After describing the method of inhaling the vapor by introducing a tube into the upper part of a bottle containing ether, it is said "by the imprudent inspiration of ether a gentleman was thrown into a very lethargic condition, which continued with occasional periods of intermission for more than thirty hours, and a great depression of spirits; for many days the pulse was so much lowered that considerable fears were entertained for his life." In 1831,[1] we find recorded the case of a female who perished by sleeping in a room in which a large jar containing nitric ether had been broken. "She lay on her side, with her arms folded, the countenance and the posture composed, and the whole appearance that of one in a deep sleep." Two other cases, which terminated in recovery, after a prolonged state of lethargy, are referred to in the same journal. In the edition of his Materia Medica published in 1839, Dr. Pereira makes the following statement: "The vapor of ether is inhaled in spasmodic asthma, chronic catarrh, and dyspnœa, whooping-cough, and to relieve the effects caused by the accidental inhalation of chlorine gas." In a Treatise "On the Practical Use of Inhalations in Diseases of the Throat and Chest, by John Harwood, M.D., etc.," of which a second edition was published in 1839, the inhalation of ether as an antispasmodic medicine in difficulty of breathing is recommended. This physician, who devoted himself to the application of medicines by inhalation, and appears to have used in this manner every narcotic and antispasmodic medicine rather than ether, was upon the very verge of the discovery of "anæsthesia," but missed it by not venturing far enough in the use of ethereal vapors. "Although, when swallowed," he remarks, "the operation of ether is usually regarded as narcotic and anodyne, yet in inhalation, its sedative or antispasmodic influence appears liable to be overwhelmed by its stimulant properties." In March, 1846, M. Ducros addressed a paper to the French Academy of Sciences, in which he showed that sulphuric ether introduced into the mouth of the gallinaceæ produced immediate somnolence with closure of the eyes, erection of the feathers, etc., and stated that when applied in like manner to the human subject, it was capable of arresting puerperal, hysterical, and epileptiform convulsions.[2]

The power of ethereal vapors to produce exhilarating effects, which closely resemble those of nitrous oxide, is familiar to our countrymen, as having been long employed for this purpose in schools and colleges. It is remarkable that the insensibility to pain, shown by many of the persons who thus inhaled it, should not have attracted more attention. For not unfrequently the experimenters became very violent while under the influence of the vapor, and sustained injuries to which they remained nevertheless insensible until after the return of their ordinary condition. The

[1] Edinb. Med. and Surg. Journ., xxxv. 452.
[2] Abeille Méd., iii. 102.

same thing was also observed in the popular exhibitions with nitrous oxide.

On September 30, 1846, the first of the new series of experiments which demonstrated the anæsthetic powers of ether was performed by Dr. Morton, a dentist of the city of Boston, in the manner described below. On the 16th and 17th of October the first public use was made of ether by Drs. Warren and Hayward, in surgical operations at the Massachusetts General Hospital.[1]

No sooner were these results known, and the credit of obtaining them awarded to Dr. Morton, than his claims to the distinction were contested by Dr. Charles T. Jackson, an eminent chemist and geologist of Boston. The latter, indeed, maintained that the knowledge of Dr. Morton respecting the anæsthetic properties of sulphuric ether was wholly derived from himself, and he sustained his claim to a previous acquaintance with its virtues by showing that as early as 1841–2 he had inspired either to remove the painful effects of an accidental inhalation of chlorine gas. But, as has been seen, this quality of ether was already known, and had been published by Pereira. In Dr. Jackson's history of his own share in the discovery of the anæsthetic properties of this liquid, he states that after the experiment above referred to "he felt prepared to recommend the trial of sulphuric ether vapor for the prevention of pain in surgical operations." But there is nothing to show that he mentioned the anæsthetic properties of ether to any one, until February, 1846, when he recommended this liquid to one of his students, as a means of preventing pain in the operation of extracting a tooth. But the ether was not used on this occasion, and does not seem to have been referred to again by Dr. Jackson, until late in September, 1846, when Dr. Morton applied to him for the loan of an India-rubber bag, for the purpose, it was alleged, of calming a refractory patient, by causing her to believe that she inhaled from it something to assuage pain. Dr. Jackson discouraged this notion, and then spoke of the properties and the modes of using sulphuric ether, and advised Dr. Morton to employ it instead of attempting to play upon the patient's imagination.

How far these statements were novel to Dr. Morton must forever remain uncertain. But that they were not altogether so, there is every reason to believe. It is proved by abundant evidence that, during at least two months before the date of this interview, Dr. Morton was in search of an agent to prevent or palliate the pain of dental operations, and that he was led to the inquiry by certain experiments of his former associate Dr. Wells, a dentist of Hartford, Connecticut, who endeavored to make nitrous oxide gas available for the purpose, as Sir H. Davy had originally suggested. After abandoning his attempts with this gas, it is proved that during a part of the summer and the month of September, 1846, he was

[1] Dr. C. W. Long, of Athens, Ga., claims to have employed ether as an anæsthetic in surgical operations in 1842. (*Boston Med. and Surg. Journ.*, April, 1861, p. 229.) It is unfortunate that he should have failed to communicate results, at that time so singular, to the medical profession.

experimenting with sulphuric ether. But, from whatever cause, he does not appear to have been successful, until Dr. Jackson pointed out to him the proper mode of inhaling it.[1]

Immediately after his interview with this gentleman, Dr. Morton returned home, and, putting into practice the suggestions he had received, is said to have inhaled some ether from a handkerchief, and to have remained insensible for eight minutes. It is certain that on the evening of the same day (September 30, 1846) he administered ether to E. H. Frost. This person testifies, and his testimony is confirmed by two witnesses, that he applied to Dr. Morton while laboring under a most violent toothache, that Dr. M. "took out his pocket-handkerchief, saturated it with a preparation of his, from which," says the deponent, "I breathed for about half a minute, and then was lost in sleep. In an instant more I awoke, and saw my tooth lying on the floor. I did not experience the slightest pain whatever." *Thus the first operation ever rendered painless by ether was performed by Dr. Morton on the* 30*th September*, 1846.[2]

On the following day Dr. Morton called on Dr. Jackson and informed him of his success, and was advised to get the surgeons of the Massachusetts General Hospital to permit the use of the ether in that institution. Dr. Morton then waited upon Dr. Warren, who promised him an early opportunity of trying an experiment. Accordingly, on the 16th of October, the ether was administered to a man on whom Dr. Warren was about to operate for a tumor of the face, and on the following day to a female with a fatty tumor of the arm, which was removed by Dr. Hayward. In the first case the effect was not complete, but in the second "the patient was insensible during the whole time, and was entirely unconscious." On the 7th of November, Dr. Morton administered the ether to a female patient at the hospital, on whom Dr. Hayward performed the operation of amputation of the thigh; "it was entirely successful in preventing pain, the woman asserting that she had been wholly ignorant of the operation." Other operations were immediately afterwards performed, under the same favorable circumstances, by Drs. Townsend, J. M. Warren, Parkman, H. J. Bigelow, and Pierson. Among them were two cases of reduction of dislocation of the humerus.

It was not long before the news of the discovery crossed the Atlantic in letters written by Dr. Bigelow to Dr. Boot, of London,[3] and by Dr. Ware and Dr. Warren to Dr. Forbes.[4] In London,

[1] It is a singular coincidence that chloroform and ether should both have required for their introduction, as anæsthetics, the co-operation of a scientific and a practical man. What Dr. Jackson was to Dr. Morton, in this country, Mr. Waldie, the chemist, was to Dr. Simpson, in Great Britain. Practical genius is not less essential than scientific genius to the advancement of society.

[2] Although Sir James Y. Simpson, after his employment of chloroform, appeared to contemn ethereal anæsthesia, he nevertheless at one time recognized the claims of Dr. Morton in the following words addressed to him: "Of course the *great* thought is that of producing insensibility, and for that, the world is, I think, indebted to you."—*Boston Med. and Surg. Journ.*, Dec. 1869, p. 319.

[3] Lancet, Jan. 2, 1847.

[4] Brit. and For. Med.-Chir. Rev., xiv. 309.

etherization was immediately used by Dr. Boot and Mr. Robinson in operations on the teeth on the 19th of December, and on the 21st of the same month Mr. Liston tried it with perfectly satisfactory results in a case of amputation of the thigh, and in another requiring evulsion of both sides of the great toe-nail.

The Parisian surgeons were not slow in putting to the test the new method of preventing pain. On the 12th of January, 1847, M. Malgaigne reported to the Academy of Medicine the results of its use in several operations performed by him, including an amputation of the leg. Although his example was speedily followed by nearly all of the surgeons of France, the practice was at first denounced as hazardous by Magendie, Lallemand, Flourens, Roux, Velpeau, and other distinguished persons. They soon, however, yielded to the rapidly accumulating evidence in favor of the new method. On the 7th of the same month it was used at the Clinical Hospital of Madrid by Dr. Argumosa.

In Belgium, the anæsthetic was first applied by Bosch, of Brussels, at the same time that Malgaigne was employing it in Paris, and within a few days afterwards (Jan. 27th) Prof. Schuh, of Vienna, operated upon patients subjected to its influence. In Erlangen (by Prof. Heyfelder), in Liepsic, and Munich, it was directly afterwards resorted to, and on the 6th of February by Behrends in Berlin. Dieffenbach in the last-named place, and Chelius in Heidelberg, very soon adopted the new method, but with greater reserve. In a word, the instances of its use multiplied so rapidly that it became impossible to note their peculiarities. The lowest as well as the highest class of physicians and surgeons employed the wonderful liquid, and sometimes with so little circumspection or knowledge of its properties as to cause alarming and even fatal effects. Its administration was on this account forbidden to all persons except physicians in one of the kingdoms of Germany.

While these events were in progress, and from one end of Europe to the other etherization was adopted by almost every surgeon of distinction, the practice made very slow progress in the country of its birth. Several weeks elapsed after the publication of Dr. Bigelow's paper before the subject was noticed by the medical press of the United States, and then it was in tones of doubt and incredulity, and it was not until several months had passed that the practice became at all popular south of Boston. The first operation performed under the influence of ether in the New York Hospital was on February 13th, 1847.[1] This hesitation to accept the new discovery is in some degree attributable to the taint of charlatanism which at first attached to it; to the endeavor to preserve it as a secret; to the title of "Letheon" with which the ether employed in the first operations was decorated; and to the disgraceful attempt of those who introduced it into surgical practice to obtain a patent-right for their discovery. But even after these obstacles were overcome, and this sordid conduct forgotten, there was neither so

[1] Trans. Am. Med. Association for 1848.

general a use of this agent, nor afterwards of chloroform, by American surgeons as by those of the Old World, and we have consequently less cause than the medical profession of Europe to deplore the fatal results which must be set to the account of the latter at least of these anæsthetics.

Etherization of Animals.—Messrs. Cook and Taylor performed upon frogs, guinea-pigs, linnets, and rabbits some experiments, from which they drew the following description of the effects produced by inhaling ether.[1] "A feeling of discomfort, indicated by a distressed look, glassy eye, and attempts to escape, is quickly followed by more rapid and powerful contractions of the heart, by increased rapidity of circulation throughout the whole vascular system, by deeper and laborious or by more frequent acts of inspiration, and an excited condition of the brain. Then the cerebral functions become oppressed, sensation and the power of motion become more and more impaired, the action of the limbs becomes irregular and wild, and the animal, reeling and staggering from side to side, eventually falls down as if lifeless; but respiration still goes on, the capillary circulation is unusually active, and, although the muscular system generally is in a state of relaxation, the involuntary muscles seem preternaturally excited; both the urine and the fæces may be suddenly voided. This stage of complete insensibility is followed, after a time, by symptoms of congestion of the brain; the respiratory act becomes less frequent; the blood, of a dark-blue color, stagnates in the capillaries; the extremities feel cold; the lips are blue and livid, and, if the animal be not speedily removed into the open air, respiration first stops, then the contractions of the heart become fainter and fainter; lastly, the peristaltic action of the intestinal tube ceases."

According to Gruby's experiments on various animals, the respiration at first becomes quickened and then labored. If the inhalation is still persisted in, death soon takes place. Relaxation of the muscles is a constant phenomenon. Sensibility is completely extinguished by ether, and death, when it occurs, seems to be caused by congestion of the brain and great viscera, and by paralysis of the respiratory muscles. Depletion has restored dogs to consciousness even after they had ceased to breathe.[2]

M. Longet has furnished perhaps the best analysis and interpretation of the phenomena under consideration. Among his conclusions the following are the most important: 1. The inhalation of ether produces complete but temporary insensibility in the cerebro-spinal axis and in the nerves; 2. When a compound nerve is directly etherized it loses its sensibility in all of its trunk and branches beyond the point at which the ether is applied, but may nevertheless retain the function of voluntary motion; this statement is confirmed by Serres;[3] 3. Ether suspends completely but temporarily the reflex function of the spinal cord; 4. For some

[1] Lancet, June 19, 1847. [2] CANSTATT's Jahrbuch., 1847, p. 159.
[3] Arch. Gén. de Méd., 4ème sér., xiii. 433.

time after etherized animals have recovered their perception, sensibility is often temporarily augmented: 5. Insensibility always takes plack before black blood can be obtained from the arteries; 6. The continued inspiration of ether after insensibility has taken place is almost certainly fatal; but if atmospheric air be mixed in due proportion with the ethereal vapors, the state of insensibility may be very much prolonged without danger to the animals (rabbits) employed; 7. Ether taken into the stomach in quantities sufficient to destroy life does not at any time produce anæsthesia.[1]

The experiments of M. Flourens[2] led to substantially the same conclusions. He found that in etherized animals *the loss of sensibility precedes that of motility*, but both are ultimately suspended; and yet the animal lives, because the automatic or excito-motory acts of respiration and of the heart continue. According to his views of the nervous system, *the cerebral lobes*, or the seat of intelligence, *first lose their power;* then the cerebellum, which presides over *equilibrium in locomotion;* the medulla spinalis next loses its faculty of *sensation and also of motion;* and finally the function of the *medulla oblongata* alone survives. When the last is overcome, death takes place. According to the physiologists now cited, the mode of death in question is not asphyxia, for that is only a negative loss of life, produced by the want of oxygen, but death is to be regarded as resulting positively and directly from the deleterious action of the ethereal vapor itself.

Ether, when taken into the *stomach* of animals, does not, according to Longet, Flourens, and others, produce insensibility, but only intoxication. But the Russian surgeon Pirogoff declared that when ether is thrown into the rectum, it gives rise to the very same effects as when it is inhaled.[3] To insure its gradual and complete effect, the liquid should be injected very slowly, or be previously converted into vapor. Dupuy's experiments upon animals show that by this method loss of sensation is as soon produced as by inspiration, and no signs of asphyxia arise.

Several observers have examined the influence of ethereal respiration upon the condition of the venous blood and of the nervous tissue. In general, the arterial blood grows very dark soon after the commencement of insensibility; but, on the suspension of the etherization, it regains its usual color, and at the same time sensibility is restored. Lassaigne found that the clot of blood drawn soon after etherization is relatively smaller and firmer, and the serum augmented; and also that the blood has an unusually florid color, which it retains for several days. According to other experiments, however,[4] the venous blood of etherized horses continues to be darker than natural during as many as seven days; it at the same time runs more freely, furnishes but little serum, and for the first three days smells strongly of ether. The breath of the animals may emit the same odor during five days. A goat's milk exhaled

[1] Arch. Gén. de Méd., 4ème sér., xiii. 375.
[2] Ibid., p. 434.
[3] CANSTATT's Jahrb., loc. cit.
[4] STRUMPF, loc. cit.

this smell for five days after the animal had breathed the vapor of ether. The flesh of animals slain during insensibility from ether retains its odor for many days, and indeed it cannot be wholly removed by roasting or boiling. It is an interesting fact that the inspired vapor of ether dissolves the fatty element of the cerebral substance. Bibra, and Harless, in Erlangen, found in the brain and spinal marrow of etherized animals a diminished proportion of fat, while an excess of this substance existed in the liver.

In animals killed during the first stage of etherization the lungs are found very much congested; in the second stage, when the respiratory act is more energetically and actively maintained by the aid of the abdominal muscles, an emphysematous condition of the margins of the lungs is sometimes produced, and sometimes also of the entire structure, to such a degree as to prevent the organs' collapsing when removed from the body.

Action of Ethereal Inhalation on Man.—A glowing or burning sensation is first experienced in the posterior fauces and the larynx, with an increased discharge of saliva, a disposition to cough, oppression and shortness of breath. These unpleasant feelings are of short duration. A general feeling of warmth succeeds; a sense of comfort and exhilaration diffuses itself over the whole body. The fingers and toes grow numb, and so, by degrees, does the entire cutaneous surface, in which is previously felt a prickling sensation like that of parts said to be "asleep." The patient is conscious of a momentarily increasing lightness and freedom of motion, all sense of weight vanishes, and the earth seems to reel under the feet. Taste and smell are the first of the special senses abolished, owing to the direct action of the ether upon their organs; hearing grows dull or perverted, and words and other sounds sometimes sound strangely loud, seeming as if echoed in an empty place, and rushing noises fill the ears. The sight in some cases becomes singularly clear, and the outlines of objects appear sharply defined; but sometimes it grows dim, or is mocked with extravagant illusions. Perversions of the senses often attend the commencement of etherization and the period between awaking and the complete return of consciousness. Of this sort is the sense of rapid flight through the air, of unearthly music, gorgeous spectacles, and magical phantasmagoria. The sense of smell is sometimes so far perverted that ammonia, for instance, has a grateful odor. Dizziness and a disposition to repose follow, and the skin may then be pricked or cut without producing much, or indeed any, pain. It is remarkable that although the sensibility to pain is abolished, the sense of touch may remain unimpaired. A patient may be conscious of the contact of external bodies—of surgical instruments, for example—and yet be wholly insensible to pain. Last of all, the remainder of the special senses are dulled or quite suspended, although it is not uncommon for the hearing to remain perfect during the whole process, especially if the patient make an effort to exercise it. But in general there is an absolute and complete insensibility to all external impressions, while the mind is filled with a rapid succession of

ideas, which are for the most part of a lively description. Their character seems, however, to be determined very much by the natural disposition or the actual state of the patient's mind, just as the complexion of one's dreams is apt to be a reflection of his habitual cast of thought.

Such are the symptoms of which the patient himself is conscious. Another series of phenomena is presented to the observer. At the outset the pulse is generally quickened, but varies greatly in its characters; the breathing grows more rapid, the skin warm and moist, the pupils contracted, and the face assumes a livelier expression and color. Not infrequently more or less excitement or restlessness succeeds, and may amount even to delirium, with pugnacity. The particular form of excitement is, however, as various as that from alcohol. Some persons sing, and some lament; some weep, or moan, or sigh; some tremble, choke, or vomit, and many grow restless, and rave wildly. The latter symptoms are most apt to be presented in persons of an irritable, nervous, or hysterical constitution. The excitement may abate very suddenly—it does so, in most cases, very soon; the disposition to active movements ceases altogether; the limbs grow flaccid, the back bends, the chest sinks down; the speech grows hesitating, the ideas unconnected; the eyelids droop and quiver, the eyeballs are upturned, and the pupils usually dilated; the breathing is slow and deep; the pulse generally infrequent, small, and compressible, but sometimes it is quickened and irregular, and the heart acts in a corresponding manner; the skin is generally cool and moist; thefea tures are sometimes purplish and sometimes pale, and quite dull and expressionless; sense and motion have ceased, muscular contractions can no longer be excited, and the patient lies in a trance-like sleep, which has so strong a likeness to death, that few persons can observe it for the first time without alarm.

This state is of short duration (although it seems to the patient to have lasted a long time), and it vanishes almost instantaneously. Even when stupor is produced, it continues for a few moments only after the vapor ceases to be breathed. The patient opens his eyes, is amazed at what has happened to him, and at the short time he is told that he has been asleep; he endeavors to rise, and for some time his ideas are confused, and his sensations are remembered like those of a dream. Very commonly, too, he is excited, and laughs or weeps without motive. His sensibility is apt to be morbidly keen; the pulse becomes fuller and more regular, and the respiration more frequent and natural. Hearing, smell, sight, taste, and feeling return in the order in which they have been named, but their perfect activity is very slowly regained. Indeed, there remains for some time a general sense of lassitude and weariness, as after severe fatigue. The gait is still tottering, there is a tendency to faintness, a general malaise, an unpleasant and enduring smell and taste of ether, and, for several days, all of the secretions exhale the same odor.

In some cases ethereal inhalation occasions its appropriate symp-

toms within a minute, and in others not for twenty minutes or longer. The duration, also, of these symptoms is unequal, varying from less than a minute to more than an hour. Heyfelder relates a case in which they lasted for several hours, but in general their duration is proportioned to the completeness and length of the process of inhalation. Persons are occasionally met with who seem to be wholly insusceptible to the action of ether, and some who can never be carried beyond the stage of excitement by its means. Some have even the power, by mere force of will, to lessen, if not entirely to prevent, its effects. These peculiarities resemble the more familiar ones of persons who seem incapable of intoxication by alcoholic drinks.[1] Heyfelder arranges the diversities in the phenomena of etherization under the following heads: 1. Complete loss of sensibility and consciousness, which is not unfrequently conjoined with complete collapse. 2. A very marked diminution of sensibility, with an incomplete loss, or, on the other hand, a complete retention of consciousness.[2] 3. Excitement with imperfect consciousness. 4. Excitement with ordinary consciousness, or with ordinary or even exaggerated sensibility.

Etherized persons not unfrequently present very different phenomena from those which have been detailed. As already remarked, sensibility is not always destroyed. Some patients, too, show signs of extreme suffering during severe operations, and yet, on the return of consciousness, declare that they experienced no pain, but that they had been dreaming, and they even affirm that their dreams were delightful.[3] Magendie has drawn attention to the erotic dreams of some females, and most practitioners who have employed ether have met with instances of the same sort.[4] "In some it has been evident, from the movements of the patients, that they were under the influence of the fully-developed venereal orgasm." Other patients awake as from a nightmare, and describe their visions and sensations as having been extremely distressing; that they have suffered violence, been constrained to act against their will, etc. Some not only remember the pain they seemed to suffer, but assert their sufferings to have been greater than if ether had not been employed.

A number of instances which serve to illustrate this subject are related in a paper on the "Psychical Effects of Ether Inhalation,"

[1] A neuralgic patient is stated by Larue to have inhaled nearly eighty pounds of ether during five weeks. He became very much emaciated, and feeble in mind as well as body. With a disuse of the ether, and a cordial and invigorating regimen, he soon recovered his previous condition.—*Boston Med. and Surg. Journ.*, Feb. 1865, p. 57.

[2] Dr. Lente relates the case of a boy, who, during a very painful and tedious operation, was quite insensible to pain, "and yet he was laughing and talking, and making droll remarks, in conversation with the bystanders, most of the time." (*New York Journ. of Med.*, viii. 622.) Another case in which volition was preserved during anæsthesia is related by Shepherd. (*Boston Journ.*, Dec. 1868, p. 288.) Such a condition is not unusual during alcoholic intoxication.

[3] BRIERRE DE BOISMONT, Revue Méd., cii. 218.

[4] Compare Dr. TYLER SMITH, Lancet, March 27, 1847.

by the late Dr. Moreton Stillé,[1] whose general conclusions may be appropriately quoted in this place as a summary of many things in the preceding pages.

"1. That the consciousness or perception of external objects and impressions is impaired in the early and lost in the final stage of etherization.

"2. That during the time the mind remains susceptible to external impressions at all, these reach it in a feeble or perverted manner.

"3. That the emotions, and especially those of an erotic character, are excited by the inhalation of ether.

"4. That voluntary muscular movement is not paralyzed until the state of perfect narcotism is produced, at which time, however, all outward consciousness is extinct.

"5. That the memory of what has passed during the state of etherization is either of events wholly unreal, or of real occurrences perverted from their actual nature.

"6. That there is reason to believe that the impression left by the dreams occasioned by ether may remain permanently fixed in the memory with all the vividness of real events."

Dr. Henry Hartshorne, from another point of view—from a physiological analysis, that is, of the order of phenomena produced by anæsthetics—concludes that "*artificial acinesia*, or loss of motor power, *never occurs unless anæsthesia has preceded or accompanies it.*"[2] This conclusion is identical with the fourth of the propositions stated above.

In general, the after-effects of etherization are inconsiderable. Sometimes a pleasant exhilaration continues for several hours. On other occasions more or less distressing, and even alarming, symptoms present themselves. There is congestion of the brain or lungs, inexpressible anxiety, a frequent and thready pulse, stertorous breathing, convulsive restlessness or cataleptic rigidity with prolonged insensibility, and a variety of hysterical phenomena which are almost exclusively observed in female patients. Writers also enumerate among the consequences of etherization a temporary loss of memory, prolonged deafness, uncommon muscular weariness or exhaustion, dysury, various spasmodic phenomena and even tetanus and permanent epilepsy, unusual pain in parts operated upon, secondary hemorrhage, slowness and irregularity of the reparative process, gangrene, phlebitis, and suppurative fever; and finally death, preceded by coma, convulsions, delirium, and general relaxation.[3] Much discussion has arisen as to how far these and similar phenomena have been owing to the use of ether. Many attribute them to an improper manner of employing the vapor, many to its bad quality, and many more to the peculiarities of the patient or

[1] Phila. Med. Exam., Dec. 1854, p. 730.

[2] Trans. Phila. Coll. of Phys., Dec. 1854.

[3] See a paper by J. Henry Clark, M.D., and one by Frederick D. Lente, M.D., in the New York Journ. of Med., 3d ser, i. 181, 354.

of his disease. The last opinion is, we believe, in most cases the correct one.

At the commencement of the practice of etherization its dangers were stoutly denied by many of the most influential persons and organs of opinion. A writer in an English periodical[1] says: "We have been unable to discover, after the most extended inquiries, a single case in which the process certainly produced death, or left behind it serious consequences that were certainly attributable to it." Heyfelder, whose treatise was published about the same time, had not met with any fatal result or permanently injurious consequences;[2] and Dr. Snow's not less extensive experience during the same year furnished him with no serious accident. "Except a headache," he remarks, "on one or two occasions, the only unpleasant effect that I have ever seen from the inhalation of ether has been sickness and vomiting, which are only occasional results."[3] But a belief in the innocuousness of the process was not of long continuance. During the same year (1847), M. Lach, in his work on ether, published *nine* cases in which this fluid was the immediate cause of death;[4] and about the same time the editor of the *Monthly Journal of Medical Sciences*[5] says "*fatal effects* have become multiplied," and he mentions five or six other cases in which death was more or less dependent upon ether. In one of these, ether was declared by a coroner's jury to be the cause of death, and the surgeon himself concurred in the correctness of this verdict. Dr. P. F. Eve also reported two cases, in one of which ether was the sole, and in the other, the immediate, cause of death.[6]

Velpeau and others have attributed most of these instances of mischievous effects to the improper manner in which the ethereal vapor was administered, and it cannot be denied that the criticism is, to a great extent, a just one. A portion of them also may be justly set to the account of the operation itself which the several patients underwent, and to that shock to the constitution which is well known to be a source of a fatal issue after operations performed, not only without the use of an anæsthetic agent, but in the absence of any influence whatever of a deleterious nature. Dr. Snow[7] admits but two deaths which have been recorded as occurring *during* the administration of ether, and he adds, "it is not probable that the death in either case was due to the ether," but in the one from the want of admission of sufficient air to the lungs, and in the other from hemorrhage. In 1855, Dr. Hayward, of Boston, referring to one of the same cases, and reviewing the whole question, declared that "there is reason to doubt whether death has in a single instance been produced by it, when it has been properly administered."[8] MM.

[1] Brit. and For. Med.-Chir. Rev., April, 1847. [2] Die Versuche, etc., p. 75.
[3] On the Inhalation of the Vapor of Ether in Surgical Operations, 1847, p. 43.
[4] De l'Ether Sulphurique, et de son Action Physiologique, etc., p. 211.
[5] April, 1847, p. 799. For other cases, see BRAITHWAITE's Retrospect (Am. ed.), No. xv. p. 344.
[6] South. Med. and Surg. Journ., June, 1849.
[7] Chloroform and other Anæsthetics, 1858.
[8] Surgical Reports, etc., p. 243.

Perrin and Lallemand, in a synoptical table of sudden deaths in the anæsthetic state, enumerate only three as being due to the inhalation of ether;[1] and a committee of the Boston Society for Medical Improvement declared, in 1861, that "there is no recorded case of death, known to the committee, attributed to sulphuric ether, which cannot be explained on some other ground equally plausible, or in which, if it were possible to repeat the experiment, insensibility could not have been produced, and death avoided. This cannot be said of chloroform."[2] If it were still objected, as it was on the first introduction of anæsthesia, that there are examples enough of death caused by this agent to prove its hurtfulness and to call for its banishment, it might be replied that the number of such cases is altogether inconsiderable when compared with the almost innumerable instances in which ether has been administered by inhalation, not only without accident, but with manifest advantage to those who inhaled it. But, still further, it may now be positively asserted, that since the proper mode of its administration has been understood, that is, since care has been taken to admit a sufficient proportion of atmospheric air along with the ether into the patient's lungs, *there is not one authenticated example of its having destroyed life in cases appropriate to the use of any anæsthetic.* This statement, which was substantially made by us in 1860, continues to be true after the lapse of fourteen years.[3] The only cases which, at first sight, may seem to render it too absolute, are such as these. In one the patient was an epileptic, and died in convulsions, without having lost consciousness.[4] In another a child was choked to death by a piece of food which she vomited, while not yet unconscious.[5] In a third the patient was drunk, and had concussion of the brain; and in a fourth the operating surgeon ordered the administrator to urge the inhalation in spite of the remonstrance of the latter. Such cases may condemn the operators, the first for administering an anæsthetic to an epileptic patient, and the second for giving it at all when the stomach contained food, etc., but they do not impugn the method. There is no medicine of great power but has occasionally had its victims, of whom some perished through its maladministration, and some through their peculiar susceptibility to its influence, yet no one thinks of banishing them from practice for such a cause. Not less unwise would it be to neglect the advantages of etherization on account of its rare, and, it must be added, questionable mishaps.

It was at one time said that the blood of etherized persons is,

[1] Traité d'Anæsthésie Chirurgicale, p. 342 (1863).

[2] Bost. Med. and Surg. Journ., Oct. 1861.

[3] In 1869 it was asserted by a physician that a patient in the Massachusetts General Hospital had died directly from the effects of ether inhalation. To this allegation a reply was published by all the surgeons of that institution declaring "that no patient ever died from the inhalation of ether in that hospital, nor were they cognizant of any such occurrence in Boston or elsewhere."—*Boston Med. and Surg. Journ.*, Aug. 1869, p. 15.

[4] Am. Journ. of Med. Sci., April, 1864, p. 550.

[5] New York Med. Journ., June, 1865, p. 223.

with few exceptions, more liquid and darker than natural, and has a small and loose clot; that it flows but sluggishly from the veins; that it smells strongly of ether, and contains a few crimped corpuscles, which were said to assume polypoid forms; that it also separates slowly and incompletely into a large, dark-colored clot, and a large proportion of dirty-brownish serum, exhaling a strong smell of ether; and that the venous blood does not undergo its appropriate changes in the capillary vessels. These statements, made in the infancy of etherization, have not been confirmed by recent observers. The blood may contain a larger number of fat corpuscles than under other circumstances. The careful observations of Dr. McQuillon prove that the inhalation of ether occasions no appreciable change in the condition of the blood corpuscles.[1]

The bodies of those who die after having inhaled ether continue for several days to emit a strong smell of this fluid from every cavity. The veins of the central organs, especially, are distended with dark and liquid blood. A thin and clear serum is found in the cavity of the arachnoid. The heart is flaccid and empty, or its right cavities are distended with black blood. The upper portion of the lungs is œdematous, and the lower engorged with dark blood. The lining membrane of the mouth, pharynx, and air passages is, for the most part, congested, and covered with mucus; the liver and kidneys are congested, the gall-bladder is distended with dark and liquid bile; and the bladder is filled with urine which smells strongly of ether.

Uses. *In Surgical Operations.*—The general effects of ether having been sufficiently set forth in the preceding pages, it is needless to describe anew the phenomena observed during surgical operations performed on persons under its influence. It may be proper, however, to consider, in this place, the precise nature of its usefulness in surgery, and the limits to its employment which have been established by experience. Undoubtedly the pre-eminent value of etherization consists in its power of mitigating, and very often of completely annulling, the sense of pain. A subordinate value is that it removes the injurious influence of pain upon the ultimate issue of surgical operations. Were it true that the former of these qualtities is the only one possessed by ether, it would still form one of the most precious resources of medical art. For pain is the one great evil of man's physical condition. The aim of his whole life is to shun it, and enjoy comfort in its stead. It is the grand hindrance to his exertions which it paralyzes, and to his progress which it retards. It is the perpetual disturber of his well-being. It forces him to desist from seeking what he desires, and mars the enjoyment of what he already possesses. When he is overtaken by disease, or receives some injury that calls for surgical interference, the dread of pain leads him to put off an appeal to the proper remedy, until, perhaps, the chances of its success are reduced almost to nothing. And when, at last, he submits to the dreaded opera-

[1] Dental Cosmos, March, 1869.

tion, his apprehension of its result depresses his vital power, and diminishes, if it does not entirely neutralize, the good he looked forward to enjoying. But anæsthesia strips the needful remedy of its terror, induces the patient to accept it while it may still be safely and successfully employed, and at the same time lessens the risk which, under the most favorable conditions of another sort, could not have been avoided.

Prof. Miller, of Edinburgh, enumerates the following among the advantages of anæsthesia in surgery, and, although his remarks refer especially to chloroform, they are equally applicable to ether. 1. Anæsthesia permits the performance of operations otherwise inexpedient or impracticable; 2. It affords great relief to the operator as well as the patient; 3. It does not favor hemorrhage, but the reverse; 4. It not only annihilates pain during an operation, but probably diminishes it afterwards; 5. It is of much service in cases of *dislocation*, in the *examination of injuries*, the treatment of *irritable stricture*, in *sounding for stone*, in the *taxis for hernia*, and in saving the feelings of delicacy and modesty in women.[1]

It can no longer be doubted that anæsthesia does really diminish the chances of failure of surgical operations. Nearly all competent authorities agree that it does so. The fact has indeed been fully demonstrated by the statistical researches of Dr. Snow, Dr. Simpson, and others. Dr. Snow published the returns relating to this subject of three of the principal hospitals of London, which abundantly confirm the presumption that the want of apprehension and the freedom from pain of the patients tended in a decided manner to diminish mortality and promote recovery after surgical operations. But Dr. Simpson has furnished numerical data which leave no room for doubt upon the subject. Having first obtained authentic returns of the mortality after amputation of the thigh, leg, and arm in the principal British and Parisian hospitals, he finds upon comparing them together that, while 29 in 100 died under these amputations performed upon patients who were not etherized, only 23 in 100 of those operated upon in the anæsthetic state perished. Later statistics by this author give a still more flattering impression of the advantages of anæsthesia. He found that, while in amputations of the thigh without ether the mortality is 44 in 100, the same operation is attended with a mortality of only 24 in 100 where ether is employed. It is unnecessary to carry these comparisons further. The entire experience of surgeons with etherization leads to the same result, and irrefutably demonstrates its value.

Almost every operation known to surgery has been repeatedly performed upon persons under the influence of ether. Experience has, however, shown to which among them it is most applicable, and to which it is unsuited. Those of the latter class are found to be much more numerous than was at first suspected. The contra-

[1] Surgical Experience of Chloroform, p. 26 et seq.

indications to the use of ether are included in the following summary.

As has been intimated, the period of infancy and that of old age augment the risk to which etherization exposes the patient. And this is undoubtedly true in spite of instances to the contrary which may be met with in medical annals. Several examples, indeed, there are of operations upon children within the year, and upon old men past four score, which have been completely successful; but these examples ought not to have the force of a rule, for the caution of surgeons has restrained them from a general employment of the method at the two extremes of life. Mr. Syme warns against administering ether to persons in a state of great weakness or exhaustion, and the counsel may be extended to apply to the weakness of infancy and the exhaustion of old age.

Almost all competent authorities unite in dissuading from the use of etherization when the patient is affected with diseases of the respiratory apparatus or affections of the brain, and when there is a tendency to hemorrhage. It is equally improper for operations in which the sensations of the patient furnish a guide to the surgeon's acts. Such is lithotrity. Operations upon the palate, uvula, tonsils, and trachea, for strangulated hernia, paracentesis for empyema, etc., are more safely and satisfactorily performed during the patient's consciousness, for in the first mentioned of these the blood may flow into his trachea and cause suffocation, and in the last two his sensations should limit the continuance of the operation.

In certain cases also the voluntary muscular action of the patient is an important means of success; such are resection of the maxillæ, the removal of deep-seated tumors of the neck, excision of the cervix uteri and of internal hæmorrhoids, and also tenotomy. Anæsthesia is contraindicated in operations in which it is important that the patient remain perfectly quiet, as in tying aneurismal arteries, all cases of ophthalmic surgery, operations for hare-lip, for strangulated hernia, for vesico-vaginal fistula, etc.; and, finally, in very brief operations, such as the extraction of teeth, the opening of abscesses, etc., the use of ether is hardly warrantable except in cases of great timidity on the patient's part. In the minor operations it is unnecessary to induce unconsciousness; it is sufficient to take advantage of the primary action of the ether which is attended with general muscular relaxation as well as anæsthesia.

These limitations to the extravagant predictions of the early advocates of etherization may be extended by the remark which Velpeau[1] was one of the first to make, viz., that this condition is not by any means so favorable to the action of the surgeon as is popularly imagined. This eminent surgeon denied that an operator can feel himself as much at ease with a patient under the influence of ether as with one who retains his sensibility. For, as he knows that the process involves some danger, he is apt to be in haste to finish his work, and this thought almost necessarily distracts him;

[1] Bull. de Thérap., xxxviii. 334.

and, as already intimated, the patient is unable to aid him by a change of position and by performing a variety of acts which greatly facilitate the several steps of the operation under ordinary circumstances.

In Midwifery.—Sulphuric ether was first used to relieve the pains of childbirth on the 19th of January, 1847, by Prof. Simpson, of Edinburgh.[1] The subject of the trial was a woman of extremely narrow pelvis. In a previous labor the fœtus had to be removed piecemeal, but on this occasion the child was, after version, born alive. It soon perished, however, but the mother, who remained unconscious during the whole process, recovered rapidly from its effects. The first case of anæsthetic midwifery in France took place on Jan. 30, 1847, under the care of M. Fournier-Deschamps, and on the 23d of the following month M. Dubois communicated to the Academy of Medicine his experience in the same field. Shortly afterwards, Siebold, of Göttingen, employed ether during labor. But so little progress had the use of this agent made in the United States that the first case of delivery under its use occurred in the practice of Dr. Keep, of Boston, on the 27th of April, in the year above mentioned.

Strange though it may now appear, the use of ether was at first strongly reprobated, both in England and in this country, upon the ground that it was sinful to prevent a suffering which had been laid as punishment upon the mother of mankind and her daughters! The objection was produced in so many quarters as to be thought worthy of refutation by good and learned men. At this day it can only be remembered as one of the hallucinations from which the wisest of mankind are not at all times nor ever wholly exempt.

The comparatively short space of time that elapsed between the general use of ether in obstetrics, and the adoption of chloroform in its place renders it unnecessary to detail minutely the results obtained by the former agent. As Prof. Simpson set the example of employing anæsthesia in midwifery, so was he the first to furnish an analysis of the results obtained by its use.[2] These may now be briefly described along with the conclusions of other competent authorities upon the same subject, including those of Dubois,[3] Chailly,[4] Roux,[5] Siebold,[6] Protheroe Smith,[7] and Channing.[8]

All observers agree with Simpson "that the inhalation of ether procures for the patient a more or less perfect immunity from the conscious pain and suffering attendant upon labor." And the authorities are equally unanimous in stating the opinion that "in difficult labor it is incumbent upon us to exhibit the ether both for the sake of the mother and the child."

[1] Month. Journ. of Med. Sci., vii. 639.
[2] Ibid., 795.
[3] Abeille Méd., iv. 82.
[4] Ibid., iv. 100.
[5] RANKING's Abstract, vi. 264.
[6] Ueber die Anwendung der Schwefel-Æther Dämpfe in der Geburtshülfe. Göttingen, 1847.
[7] Lancet, May 1, 1847.
[8] A Treatise on Etherization in Childbirth. Boston, 1848.

It has been objected by Siebold that ethereal inhalations suspend the pains of labor, and thus injuriously prolong the process. But this opinion seems to have been founded upon limited observation. General experience demonstrates that a degree of etherization sufficient to prevent all suffering during the latter period of labor may be maintained for a sufficient length of time without diminishing the expulsive efforts of the uterus and of the abdominal muscles. The condition produced is comparable to that which has repeatedly been witnessed in cases of coma and of paraplegia, where these efforts (depending on the excito-motory function of the spinal marrow) remained unimpaired, and labor was completed without the voluntary aid, or even the knowledge, of the patient. Analogous instances have also been observed of women taken in labor while drunk, and who have given birth to their offspring while in a state of perfect unconsciousness. Dr. Simpson declares that etherization does not diminish the strength and regularity of the uterine contractions, unless a very deep state of insensibility is induced, and that in the latter case they resume their activity when the slighter degree of influence is resumed. Dubois, while admitting the occasional suspension of the pains, denies that it takes place frequently, and holds that the full activity of the uterine and abdominal muscles is generally maintained. Dr. Channing states "that he has not met with a single case in which diminution or suspension of contraction has occurred which has differed from those in which these same things have happened without ether." And he subsequently declares, even more emphatically, that, "so far from uterine contractions being diminished or suspended by ether, it is notorious that they are often increased in force and efficacy by inhalation." All observers are further agreed that the abdominal muscles contract readily during etherization, and that it does not, *unless excessive*, hinder the contraction of the womb after delivery.

Etherization preserves the mother from the shock and exhaustion of the throes of labor, especially during its last stage, and this doubtless accounts for the more rapid recovery which follows instrumental as well as natural labor performed under its influence, than when ether has not been employed.

There is no evidence that etherization is injurious to the child. Dr. Simpson has indeed known the heart of the fœtus to beat somewhat more rapidly when the mother has been kept long and fully etherized, but no evil consequences have ensued. Finally, it is pretty generally agreed that the soft parts of the mother are very sensibly relaxed during the process; the resistance of the *perineum* is lessened, and the passages are more freely lubricated by their proper secretion. Indeed no means of overcoming *rigidity of the os uteri* are so certain or so prompt as etherization.

It may be added that ether has been used successfully to combat *after-pains*, and that, according to some authorities, the secretion of milk is promoted by the fact of the patient having been delivered under the influence of this agent.

The following propositions, laid down by Dr. Cotting, of Roxbury, Mass.,[1] appear to be a just summary of this important subject, and as such we commend it to the reader.

I. That in ordinary cases of midwifery, while ether may be allowed in moderation when importunately demanded by the patient, it is quite as well, in the long run, to say the least, to let normal, uncomplicated labors proceed uninterfered with.

II. That in painful, laborious, or complicated labors, and in cases of great tenderness or great rigidity of the organs, of extraordinary susceptibility to pain, and where there is great nervous irritability, or undue apprehension of danger, ether, if favorably received, should be used to the extent of overcoming the abnormal condition and suffering.

III. That in cases requiring manual or instrumental interference, ether should be used to the same extent and upon the same general principles as in other operations involving pain and danger to the patient.

IV. That in puerperal convulsions, especially in those having the character of uræmic eclampsia, ether should be given as soon as there are indications of an approaching fit, and be continued, if seemingly efficacious, until the paroxysm has subsided, and quiet sleep is induced, or until other medicine, if desirable, can be swallowed, care being taken to allow a sufficiently large quantity of pure air, and not to continue the ether if coma supervene.

V. That as all volatile anæsthetics yet tried, except ether, have been known to cause severe accidents, and even instant death, though given with the greatest care by experienced practitioners, and this, too, before any considerable quantity had been inhaled, ether only should be used as an anæsthetic in midwifery.

It is very remarkable that while a certain number of deaths after surgical operations have been set to the account of etherization, there does not seem to be a single instance on record of this result attending etherization in childbirth. This striking fact may perhaps be attributed to the less favorable condition of general health in which patients under the hands of the surgeon are generally found, in consequence of previous exhausting disease, or the shock of an injury recently sustained, or else the shock of the operation. The excited condition of the parturient female is probably not without a share in her immunity from danger.

Various Diseases.—On comparing the several reports that have been published concerning the employment of ether in disease, it is evident that two classes of affections have been almost exclusively benefited by it. These are painful and convulsive affections, in which the symptoms arise from a derangement of one or the other of the two great functions of the nervous system, sensibility and motility.

Neuralgia.—Numerous cases are recorded which show that the inhalation of ether is one of the most prompt and efficient pallia-

[1] Bost. Med. and Surg. Journ., Dec. 1858, p. 372.

tives of this painful malady, and that occasionally it seems to contribute to a permanent cure. Relief is obtained by a degree of etherization short of insensibility, and which may be prolonged, if necessary, for several hours. The inhalation of ether, in conjunction with the local application of chloroform, or even of atomized ether itself, is now, it may be presumed, almost universal in the treatment of this affection.

Tetanus.—Reichert was, perhaps, the first to record a case of idiopathic tetanus in which inhalations of ether produced a speedy and perfect cure.[1] Other examples of traumatic tetanus cured by this remedy are reported by Mr. Hawkesworth,[2] by Mr. Hopgood,[3] by Mr. G. H. Smith,[4] and Dr. Theobald, of Baltimore.[5] In the last example, the control of ethereal vapor over very severe tetanic convulsions, was fully illustrated by the progress of the patient's improvement, which was irregular and interrupted in the same degree as the administration of the remedy. In all of these cases the effect of the ether was immediate and decided. Indeed, in several of them it evidently saved the patient's life in spite of the incongruous and somewhat harsh treatment employed at the same time.

Chorea.—It has been found that the spasms of the disease subside during the application of atomized ether along the spine. Although it has been more efficient in recent cases, and especially in those arising from fright, it has sometimes proved serviceable in more chronic cases and in rheumatic chorea.

Hysteria.—Nothing so distinctly moderates the paroxysms of this disease as the inhalation of ether. Some observers have indeed found the spasms to be aggravated by a certain degree of etherization, but there is no doubt that in these instances too small a quantity of the vapor was employed. A persistence in using it would undoubtedly have put an end to the fit. It is no argument against this use of ether that it sometimes excites in healthy persons spasms of an hysterical type. The fact that, when duly administered, it arrests such spasms is the only proper ground on which to base its remedial application in the present case.

Puerperal Convulsions.—Dr. Cabot was the first to publish a case of its successful use in this affection,[6] but it does not appear to have been frequently employed. The general success which attends venesection in puerperal convulsions, proves them to depend upon something more than the simple element of perverted innervation, and to require, therefore, a compound treatment. Perhaps after depletion ether would become more appropriate. It was thus used in a case reported by Dr. Griscom, of Philadelphia.[7] The patient was plethoric and anasarcous. Two pints of blood were taken by cups and leeches from the head, and inhalations of ether com-

[1] CANSTATT, op. cit., 1847, p. 164.
[2] RANKING'S Abstract (Am. ed.), v. 341.
[3] Ibid., vii. 36.
[4] Lancet, Dec. 1849.
[5] Am. Journ. of Med. Sci., N. S., xv. 96.
[6] Dr. CHANNING, op. cit.
[7] Trans. of Coll. of Physicians of Philadelphia, March, 1856.

menced. After its exhibition the convulsions became less frequent and violent, and at the end of seventeen hours a living child was born. A similar instance occurred in the practice of Dr. N. J. Knight,[1] and, under like circumstances, etherization was recommended by Dr. Cotting. This practice has been successfully pursued by Dr. Storer, Dr. Channing, and other physicians of Boston. Abroad, it would not appear that ether has been employed in puerperal convulsions, although many cases of the successful treatment of such convulsions by chloroform have been published. It is evident that either of these anæsthetics may prove advantageous in proportion as the convulsive attack partakes more of the irritative or hysterical and less of the congestive or apoplectic form.

Infantile Convulsions.—In proportion as the attack is simple, *i. e.*, independent of material organic causes, and produced by a morbid susceptibility of the nervous system, will ether control the convulsive phenomena. Their recurrence is to be prevented by agents appropriate to the special cause of the attack, and applied, according to circumstances, to the gums, the stomach, the bowels, etc.

Whooping-Cough; Spasmodic Asthma, etc.—Dr. R. Willis states that he used ether by inhalation in these diseases for several years before the discovery of its anæsthetic properties.[2] In *asthma*, he remarks, ether had long been familiarly employed, given by the mouth, but "I have for many years been aware of the fact that it is vastly more efficacious administered directly in vapor by the breath. . . . . . . A single short and difficult inspiration is hardly made before the effect is experienced; and I have occasionally seen the paroxysm ended in six or eight minutes, the respiration having in that brief interval become almost natural. It is not otherwise with *whooping-cough*; the paroxysms of coughing are positively cut short by using the ether when the fit is perceived to be coming on. So effectual have I seen its immediate application, that I have found it necessary to suffer the patient to have an occasional fit of coughing to its natural termination, with a view of clearing the chest from accumulated mucus." Some cases of nervous *aphonia* have been cured by the inhalation of ether. Although we have met with no published cases of the use of ethereal inhalations in *spasmodic croup*, there can be no doubt that the nervous element of the attack, in this disease, may be favorably modified by them. Even in *membranous croup* it must mitigate the distress and danger arising from the same cause, and thus prolong the period during which other remedies, such as lime-water and emetics, may operate to soften and promote the discharge of the membranous exudation. A case which appears to sustain this judgment has been published by Dr. R. R. Livingston.[3]

Delirium Tremens.—Dr. Upham, of Boston, has related a violent case of this affection, which was arrested in full career by the

[1] Boston Med. and Surg. Journ., Feb. 1857, p. 33.
[2] BRAITHWAITE's Retrospect (Am. ed.), 1847; xv. 103.
[3] Am. Journ. of Med. Sci., April, 1867, p. 376.

inspiration of ether. In that form of it distinguished by great restlessness rather than violence, with a weak pulse, and cool extremities, the remedy should not be carried to full anæsthesia.

Mania.—Ether has been repeatedly employed in this disease with the effect usually of palliating the paroxysms, and in some recent cases it seemed to contribute to the cure. It has also proved useful in some of those distressing instances of active mania in which the patient continues to move incessantly without a moment's sleep for weeks at a time, by procuring sleep, and thereby abridging the period of excitement. In certain cases of puerperal mania, it has apparently cut short the disease at once.

Dysmenorrhœa, etc.—This affection, in which violent uterine spasms and excruciating pain are conjoined, presents one of the fittest occasions for employing ether. It unquestionably shortens the paroxysms while it moderates or completely annihilates their pain, and at the same time spares the patient that profound exhaustion which follows each attack, and, by its frequent renewal, undermines the general health. It is equally applicable to the relief of *after-pains.* The pain caused by *the passage of biliary and urinary calculi* through the excretory ducts of the liver and kidneys has an analogous origin to that just described, and is even more severe. Yet it is completely under the control of ether, which keeps the patient in a state of comparative comfort, until the escape of the calculus relieves him entirely. If, moreover, the excretory ducts referred to are really capable of being thrown into spasm by the irritation within them, ether, by relaxing this spasm, must render the passage of the calculus through them more rapid than it otherwise would be.

Some *feigned diseases*, those, at least, in which the body or limbs appear to be rigidly bent or distorted, are readily discovered by etherizing the patient, and suspending for the time his volition. The fraud then becomes immediately apparent.

Administration.—The ether to be used in inhalation must be perfectly pure—that is to say, free from any of the acid used in its preparation, as well as from uncombined alcohol. For this end it should be washed thoroughly with water, allowed to stand for a short time, then carefully decanted, and dried with chloride of calcium.

Etherization should never be employed after a full meal; for either vomiting will be induced, or else an unpleasant degree of fulness about the head and stomach will remain after the operation. The position of the patient, while inhaling, should be that which will be most convenient for the subsequent action of the surgeon or accoucheur. All needful preparations should be made beforehand, so that the operation may be commenced immediately on the supervention of insensibility.

It is very important for success that the patient's attention be not diverted by any questions, or remarks made in his hearing. He should be particularly instructed in what manner to regulate his

breathing, and be made to empty his lungs of air as far as possible before the first inspiration, which ought to be prolonged and full.

When etherization was first employed, an almost endless variety of apparatus was devised for the purpose of regulating the supply of vapor administered. But these were nearly all found to be cumbrous and inconvenient; and as early as March, 1847, Dr. Smith, of Cheltenham, introduced the practice of using only a piece of sponge large enough to cover the mouth and nostrils. Prof. Syme, after experiencing much annoyance from different forms of inhaling apparatus, finally adopted the plan of placing the ether on a piece of sponge contained in a flask which was furnished with a mouth-piece and an aperture at the side to admit the air. With this apparatus, "the patients, instead of requiring a tedious and laborious respiration, frequently interrupted by cough, yielded almost immediately to the overwhelming and not unpleasing influence of the full ethereal stream." Dr. Simpson found that for surgical purposes, and when it is not necessary to keep up the etherization above five or ten minutes, the sponge is by far the best instrument. Dr. Morton also abandoned the use of any inhaler, and adopted the sponge after the manner described by Dr. Smith. This gentleman directs that, before being used, it should be well washed in luke-warm water, and then from half an ounce to an ounce of ether, or whatever quantity is necessary to saturate the interior of the sponge, should be poured upon it. This method was preferred by Dr. Hayward, and the only one, so far as we know, employed in this country, except the napkin rolled into a hollow cone, within which a piece of sponge, or a mass of charpie, may lie, or else the ether may simply be poured upon the internal surface of the cone. According to Dr. Snow, the quantity of ether required to produce complete insensibility is usually from six fluidrachms to one ounce in the adult, and in children in the same proportion, according to their age. The quantity required to keep up insensibility during an operation is seldom greater than that which induced the state of etherization; but this statement has reference to the use of inhaling instruments, in which there is less waste than with the sponge. But by both methods the quantity consumed is far greater than when the patient respires from a closed cavity, as recommended by Porta.

Supposing a sponge or napkin to be employed, it is, when prepared as above directed, to be brought near enough to the patient's mouth and nostrils to prevent any air from entering either of these openings without being charged with a portion of ethereal vapor. If the patient coughs and strangles, the sponge or napkin may be brought up gradually to the face. But although this palliates the difficulty, it very needlessly prolongs the process. Dr. Channing states that in some persons there is so much dyspnœa and cough as to contraindicate the further use of the ether; or else they experi ence disagreeable sensations in the head, more or less severe distress, noises, flashes of light, tingling of the limbs and trunk, nausea, vomiting, etc. But all surgeons who have given due attention

to the subject agree that the symptoms just mentioned, as well as those of excitement, are owing to a too gradual and imperfect inhalation of the ether. It is therefore desirable, for the patient's as well as the surgeon's sake, that the full effect of the ether should be obtained as rapidly as possible when an operation is to be performed. And hence it is found best to renew the supply of ether by introducing it through the sponge or napkin, which should not be removed from the patient's face. In natural labor the case is somewhat different. Here it is unnecessary to produce complete insensibility and unconsciousness. It is enough to diminish suffering, and this object can be gained without the risk of bringing on the unpleasant symptoms described above. If the patient is intelligent, she can regulate the degree of insensibility produced, by the severity of her pains, and call for, or herself employ, the ether when she feels that a pain is about to commence. In general, it is unnecessary to administer the ether until the presenting portion of the child begins to distend the external parts. Cases of rigidity of the os uteri are exceptions to this rule.

It is not always easy to infer the existence of insensibility from the patient's appearance. But if the eyelids do not contract when the eyelashes are touched, if the breathing is decidedly automatic and somewhat stertorous, and the expression of the face indicates unconsciousness, the patient is in a fit state to be operated upon. Occasionally, before this stage, a spasmodic contraction of the respiratory muscles takes place, which threatens to produce asphyxia; the patient's face grows purplish, and he ceases to breathe. Under these circumstances it is advisable to suspend the inhalation until the breathing is resumed. The state of unconsciousness, which may be regarded as the normal effect of etherization, must be prolonged by meeting every indication of returning sensibility with a renewed administration of ether, which need not usually be continued longer than a minute at a time. There is very seldom, according to Dr. Snow, any struggle as the patient returns from complete to partial unconsciousness; but if there should be, the ether must be given anew, and the patient kept motionless. In all cases, however, of surgical or obstetrical operation, the care of the person who has charge of administering the ether should be given to maintaining the patient as little as possible beyond the point of complete insensibility. To do less than this, embarrasses the surgeon; to do more, may endanger the patient.

The method of Pirogoff, which consists of injecting the vapor of ether, and ether itself largely diluted with water, into the bowel, has been condemned by some who have used it, on the ground of its occasioning extreme flatulent distension of the abdomen. But many of those who have employed it to relieve painful internal maladies, such as neuralgia, spasm of the muscles of deglutition, lead colic, inflammatory pains of the joints, and cancer of the intestinal tube, report favorably of its anodyne and antispasmodic effects.[1]

[1] CANSTATT, op. cit., 1849, p. 190.

Although we believe that the profession, in this country at least, is agreed to dispense with inhalers for the administration of anæsthetics, the reader may be interested in knowing the opinion and precepts of so competent an authority upon this subject as the late Dr. Snow.

He objected to inhalers of glass and sponge because they are indifferent conductors of caloric, and hence the evaporation of the ether is very much checked. He preferred the inhaler proposed by Mr. Jeffries for the inhalation of watery vapor,[1] and which consists of a plated copper box, to the lower surface of the lid of which is soldered a spiral volute which reaches nearly to the bottom of the box. There are two openings in the lid, the one communicating with the central, and the other, which is furnished with a tube, with the peripheral portion of the spiral cavity. If, now, ether be introduced into the box, and air be drawn from the tube, it is obtained highly charged with ethereal vapor, particularly if the box be prevented from getting cold, by being immersed in water of the temperature of the air—say at 50° or 60° F.

Dr. Snow advises the use of a face-piece connected with the inhaling-tube. This is a box made of sheet-lead, extending from the bridge of the nose to the fossa of the chin, and to either cheek, and fitting closely to these parts. Its lower part is connected with the inhaler by means of a wide flexible tube, which, at its entrance into the mouth-piece, is protected by a valve opening towards its cavity. Its front surface also presents an aperture covered with a valve, which opens outward, and can also be turned aside. By this arrangement the atmospheric air can be mixed, in any required proportion, with the ethereal vapor, and the whole of the expired air escapes, instead of being forced back into the receptacle of ether.

At the commencement of inhalation the outer valve is left entirely open, so as to admit the vapor of ether by degrees, and avoid the irritation which would otherwise arise. About thirty per cent. of vapor of ether in the inspired air is necessary, according to Dr. Snow, to produce insensibility in a convenient time; but this proportion must be gradually reached. The quantity of ether required to produce this effect in the adult is about a fluidounce when an apparatus like the above is used, but much more when the sponge or handkerchief is employed.

The subject of etherization may be concluded with an account of the method employed by Prof. Porta, of Pavia. According to the statements of those who have employed it systematically, it has these advantages over the more ordinary methods: it requires a far less quantity of ether, it seldom or never produces sickness or excitement, it brings on anæsthesia more rapidly, and leaves behind it much less unpleasant sensations than the more common methods. It is thus described:[2] "Close the nostrils with raw cotton. Then take a pig's bladder of medium size, soften and inflate it after

[1] Lond. Med. Gaz., xxix. 821. [2] Annales de Thérap., v. 60.

enlarging its aperture sufficiently to receive the patient's mouth, and pour into it one or two tablespoonfuls of rectified ether. Apply the edges of the aperture carefully over the patient's mouth, and direct him to breathe freely. For twenty or thirty seconds no effect is produced; but, in from forty to fifty, signs of insensibility commence, and in about a minute it is complete. This state lasts from one to three minutes, and is maintained as long as may be necessary by applying the bladder anew. In more than two hundred experiments that I have made, I have repeatedly weighed the ether remaining after the production of complete anæsthesia, and found the original quantity diminished by no more than half a scruple.

"Although so small a quantity of ether is required to produce insensibility, it must reach the lungs in a certain degree of concentration, and hence the bladder should contain much more of it than will be actually inspired. This is the capital point in administering ether. The unpleasant symptoms which have sometimes attended its use arise from its too copious dilution with atmospheric air, and thus, too, the process is unnecessarily prolonged. A difficulty in other methods is the use of too large a quantity of ether, which oppresses the breathing, but no such effect takes place in this one, when only a due proportion of the fluid is used. It is very important that the breathing of the patient should be regular and free, and therefore it is well to inspire his confidence by allowing himself to apply the bladder to his mouth, until the commencement of insensibility requires that an assistant should take charge of it.

"In the long course of my experiments, the use of such a method as I have described has uniformly succeeded in producing the due effect in from fifty to eighty seconds, and always without any excitement, anxiety, or suffocation. It is objected that a bladder of the size recommended is incapable of containing air enough for respiration, I reply that it results from actual trial that an ordinary pig's bladder contains air enough to sustain the respiration of an adult during from eighty to one hundred seconds, a much longer period than the average time of inhaling the ether. The highest praise that can be given to the method here recommended is, that it has, in my hands, succeeded uniformly and without difficulty or mischance of any sort, and that the patients return to consciousness directly after the operation, and without experiencing the slightest inconvenience."

An apparatus has been contrived by Dr. Thomas, and a similar one by Dr. Lente, which has this in common with Porta's method, that atmospheric air is almost entirely excluded. But it has the advantage that a face-piece inclosing the nose and mouth is lined with flannel which is kept soaked with ether, so that a large quantity of this fluid is rapidly vaporized and inhaled.[1] This appears to be a great advantage both in relation to the quantity of ether consumed, and the rapidity with which anæsthesia is produced.

[1] New York Med. Journ., ii. 262.

The subject of local anæsthesia by means of ethereal and other vapors will be considered under the head of COLD.

CHLOROFORMUM VENALE.—COMMERCIAL CHLOROFORM.

Description.—This substance is composed of two atoms of carbon, one atom of hydrogen, and three atoms of chlorine. Now the same proportion of carbon and hydrogen united with three atoms of *oxygen* constitute *formic acid*. They are hence supposed to form a basic compound, formyl, the union of which in the present case with chlorine was intended to be indicated by the term chloroform. To express the same idea more precisely, Liebig has named it perchloride of formyl.

Chloroform is a clear, limpid fluid, of sp. gr. 1.45 to 1.49; it is not inflammable, but its vapor burns with smoke and a green flame. It is very volatile, and boils at 141° F. It has a fragrant, fruit-like odor, and a sweet taste at first, which afterwards becomes burning and pungent. It is very slightly soluble in water, but is completely so in alcohol or ether. Dr. Snow states that it is soluble in 288 times its volume of water. It readily dissolves camphor, caoutchouc, gutta-percha, wax, resin, iodine, and some other substances. Its drops are very small, eight of them on an average being equal to two minims. Its vapor is more than four times as heavy as atmospheric air, and more of it is taken up by the latter at a high than at a low temperature. Thus, 100 cubic inches of air at 40° F. will absorb only seven cubic inches of the vapor of chloroform, but at 90° F. it will absorb fifty-five cubic inches. During the evaporation of chloroform cold is produced, but not so much as during the evaporation of ether.

History.—Chloroform was discovered in 1831, almost simultaneously by Mr. Guthrie, of Sackett's Harbor, N. Y., and by Soubeiran, of Paris. In an account of it published by the former in January, 1832, it is stated that, "he had used the product very freely during the previous six months to the point of intoxication; that he had found it singularly grateful, producing promptly a lively flow of animal spirits and consequent loquacity, and leaving little of the depression consequent on the use of ardent spirits; that it promises much as a remedy in cases requiring a safe, quick, energetic, and palatable stimulus; and that for drinking it requires an equal weight of water."[1] In 1833, Dr. Black, of Bolton, Eng., spoke of it as a new remedy, "brought into use by our American brethren," and recommends it in spasmodic asthma and in adynamic states of the system. In 1834 Dumas determined its true elementary composition, and gave it the name of *Chloroform*.

The following account of the medical properties of chloroform is contained in the seventh edition of the *United States Dispensatory*,

[1] Lancet, 1847, ii. 631, from Silliman's Journal for January, 1832.

published in July, 1847, and consequently before Dr. Simpson's experiments, to be presently described: "It acts as a diffusible soothing stimulus *in the same manner as sulphuric ether*, but with this decided advantage, that when sufficiently diluted it possesses a bland, sweet taste, which renders its administration easy even to children. It has been used with advantage in asthma, spasmodic cough, the sore throat of scarlet fever, atonic quinsy, and other diseases in which a grateful and composing medicine is indicated. Professor Ives and Dr. N. B. Ives, of New Haven, speak favorably of its effects. The dose for an adult is a teaspoonful diluted with water. In affections characterized by difficult respiration *it may be used by inhalation.*"

Through an earlier edition of the work just quoted it was in 1838-9 introduced into the medical practice of Liverpool by Mr. Waldie, an apothecary, and Dr. Formby, a physician, of that town, and by the former of these gentlemen it was, in the beginning of November, 1847, recommended to Dr. Simpson as a substitute for sulphuric ether.[1] Dr. S. was at that time endeavoring to discover, by experiments upon himself and several friends, some anæsthetic agent superior to ether. Upon inhaling chloroform, the party grew exhilarated, and several of them soon afterwards became insensible.[2] With joy, yet not wholly without apprehension, the conductor of the experiments hailed this sudden but complete disclosure of a power which was to connect his name forever with one of the most remarkable events in the history of medicine, and, after satisfying himself by renewed experiments of the reality of his discovery, he put it to a public test by rendering insensible a patient on whom Professor Miller was about to operate for necrosis of the radius. From this moment the use of chloroform as an anæsthetic agent spread rapidly over the world, and gradually supplanted sulphuric ether in the medical circles of Europe and in many parts of the United States. But it never enjoyed in this country the exclusive popularity which it attained abroad.

Action. *On Animals.*—In an essay published by Dr. Glover in 1842, it was stated, among the effects of chloroform upon the lower animals, that the lungs become congested and the spinal cord loses its sensibility.[3] In 1847, M. Flourens, while experimenting on the different varieties of ether, observed that "an animal subjected to the inhalation of chloroform became completely *etherized;* the posterior roots of the spinal nerves were found insensible, and several of the anterior roots lost their function.[4] According to Gruby,[5] the arterial blood is as red after the inhalation of chloroform as before it, perhaps even redder, and the venous blood has a brighter color than the arterial blood naturally possesses. But this assertion is contradicted by nearly all other experimenters. Amussat,[6] for example, showed by very carefully conducted experiments that when

[1] Lancet, 1847, ii. 687.
[2] Surgical Experience of Chloroform, by Prof. MILLER, p. 10.
[3] Lancet, 1847.
[4] Revue Médicale, ciii. 442.
[5] Lancet, 1848, i. 396.
[6] Revue Médicale, civ. 125.

a vein and an artery in an animal's limb are exposed so as to exhibit their contrasted hues, and chloroform is then administered, the latter vessel begins to darken as soon as the animal's sensibility declines, and finally approaches the vein in color. The blood, also, which jets from it on being punctured has the aspect of venous blood. But the instant inhalation is suspended the natural color of the fluid returns. This rapid restoration to its normal condition explains, perhaps, why some experimenters have supposed the blood to remain unchanged during anæsthesia. According to Bart, during the period of excitement which immediately succeeds the primary action of chloroform, the respiration becomes embarrassed and the arterial blood may grow dark; but during the subsequent stage, or that of resolution, the arterial blood becomes bright red, and even the venous blood may assume a bright rose-color. During the latter stage the blood, on analysis, is found to contain a larger than the normal proportion of oxygen.[1] Dr. McQuillen found that although chloroform vapor produces disintegration of the red corpuscles when they are directly exposed to it, yet no such change is presented by the blood of animals killed by breathing chloroform vapor, nor by the blood of persons in anæsthesia produced by inhaling chloroform.[2]

Duméril and Demarquay found that anæsthesia caused the temperature of animals subjected to it to fall several degrees; but this seems to have resulted only from the prolonged action of chloroform or ether.

The influence on individual susceptibilities, of the dose, and of the mode of administration, has been very clearly illustrated by Mr. Nunneley's experiments.[3] Under circumstances as nearly alike as possible, the effects were by no means identical, and even in the same animal they were far more decided at one time than another. The intensity of the effects appeared to depend upon *the quantity of chloroform inhaled in a given time.* Thus, a small quantity suddenly and quickly inhaled for a short space of time will produce not only more rapid and decided, but also far more dangerous effects than a larger quantity will do if taken more slowly, and consequently in a less concentrated form. A high temperature, which insures a speedy conversion of the chloroform into vapor, produces anæsthesia very rapidly and decidedly, and for a longer time. Consequently, whatever increases unduly the volume of the vapor inspired increases also the danger of the inhalation.

Prof. Simpson and Mr. Nunneley found that in the lower orders of animated creatures, such as fish, frogs, snails, and certain insects, it was easy to produce a local anæsthesia. In many instances, too, the local effect was followed by general insensibility, a result which doubtless depended upon the active absorbent power of the integuments of these animals. But local anæsthesia is not so easily pro-

[1] Am. Journ. of Med. Sci., Oct. 1870, p. 528.
[2] New York Med. Journ., ix. 414.
[3] Trans. Prov. Med. and Surg. Assoc., xvi. 319.

duced in the larger mammifera, and hence in man the advantages of this method are restricted to cases in which the cautery is applied or some other superficial operation is performed. In Mr. Nunneley's experiments on frogs and toads, limbs which had been subjected to the vapor of chloroform were excised piecemeal without the animals betraying any signs of pain. An inferior degree of insensibility was produced in the limbs of rabbits and dogs by prolonged immersion in the vapor of chloroform.

On Man.—Locally, and when its evaporation is prevented, chloroform acts as an irritant, and even promptly vesicates the skin. At the same time, it diminishes the sensibility of the part to external impressions. But the latter effect is very transient, while the former is of considerable duration. The vapor of chloroform, however, may be used to produce local anæsthetic effects without greatly irritating the part to which it is applied.

Taken internally in the liquid form, it produces a sense of heat in the stomach, and a diffusive warmth resembling in some degree that which is caused by alcohol. According to Dr. Henry Hartshorne, "a fluidrachm of chloroform, taken by the stomach, is not more than equal, in soporific effect, to thirty or thirty-five drops of laudanum,"[1] and a dose of seventy-five drops blunts the general sensibility, as well as the special senses, produces drowsiness, and reduces the pulse two beats in a minute.[2] This action on the pulse is not observed when chloroform is inhaled, nor was such an effect very marked in any of the following cases of poisoning by its internal use.

Mr. Dean reported the case of a lady weakened by a miscarriage, and subject to spasmodic attacks, who nearly lost her life from taking half an ounce of pure chloroform. She was seen within five minutes afterwards. The symptoms presented were as follows: General convulsions, total insensibility, dilated pupils, trismus, a slightly flushed face, a full and rather oppressed pulse, and foaming at the mouth. After the stomach was emptied, brandy was administered with evident advantage, and, although several relapses occurred, the lady finally recovered. The action of the heart during the week was singularly feeble and irregular, "one moment slow and labored, every third beat prolonged, at the next, small, quick, and fluttering, and then a prolonged stop."[3]

A case closely analogous to this has also been reported. The patient was a female, twenty-one years of age, who had swallowed two ounces of pure chloroform. She was found within twenty minutes in a deep stupor, the pupils contracted, respiration regular, pulse 70, soft and full; the face not congested. External irritants were applied; the stomach-pump used; and brandy and ammonia given. The respiration then became slow and stertorous, the pulse fell, and the face was livid. Galvanic shocks were employed, and continued for two hours, with stimulating enemata, and heat to

[1] Am. Journ. of Med. Sci., Jan. 1854, p. 113. [2] Ibid., Oct. 1848, p. 353.
[3] Times and Gaz., Dec. 1857, p. 615.

the limbs. The respiration fell to two in a minute; the pulse at the wrist was almost imperceptible. The remedies were persevered in, and reaction gradually took place. In five or six hours from the commencement consciousness returned. On the following day there was thirst, nausea, pain in the abdomen and in the lumbar region, and frequent and very bloody stools. In about a week recovery was complete.[1]

Dr. Lawson, U. S. A., has reported the case of a man who also took two ounces of chloroform, and presented essentially the same symptoms as those in the above narrative. They were, however, less grave.[2] Two similar instances have been reported in London. In the one two fluidounces of pure chloroform were taken, and in the other an unknown quantity of this liquid mixed with oil.[3]

It is believed that there is only one case on record of death from the narcotic, as distinguished from the irritant, action of chloroform taken into the stomach. A man, aged thirty-five years, who had swallowed an uncertain quantity of chloroform, fell into a state of narcotism and insensibility similar to that in the cases already related. Gradually, and under the use of galvanism and other stimulants, the temperature of the body and some slight degree of consciousness and sensibility were restored, and profuse perspiration broke out. The head became hot, and the pulse frequent and tolerably hard. There was no complaint of pain and no vomiting, but death ensued with signs of pulmonary asphyxia. On examination of the body, congestion of the brain and of the posterior part of the lungs was found, and the bronchia were choked with frothy and slightly reddish mucus. Venous congestion existed at the cardiac extremity of the stomach.[4]

In other cases the irritant action of the poison was predominant. In 1852, at Edinburgh, a robust man, in a state of intoxication from alcohol, swallowed an ounce or two of chloroform from a vial containing eight ounces of this liquid. The remainder was nearly all spilled upon the floor. Several hours afterwards, probably six or eight, he was found insensible, breathing stertorously, his face livid, his pupils dilated, and his pulse at 60, full and soft. Evacuant and stimulant remedies were employed, and his consciousness fully returned. He now began to suffer from gastric irritation, vomited all ingesta, and complained of symptoms affecting the air-passages. In about thirty-six hours he died of suffocation. On examination of his body, the mucous membrane in the pharynx, larynx, and trachea was of a crimson-red color, and in the trachea it was covered with patches of a soft, yellowish, purulent exudation, and the bronchi to their extremities were filled with a dirty-gray, purulent fluid. The cause of death was evidently an inflammation of the air-passages excited by the irritant action of chloroform.[5]

[1] Annuaire de Thérap., xviii. 55.
[2] Am. Journ. of Med. Sci., Oct. 1857, p. 367.
[3] Times and Gaz., May, 1862, p. 577; Ibid., Oct. 1863, p. 378.
[4] Times and Gaz., May, 1862, p. 478.
[5] Month. Journ. Med. Sci., v. 77.

Dr. Junius Williams has reported the following case: An intemperate female, while intoxicated, swallowed an ounce and a half of chloroform. For a few minutes she was elated, singing and dancing, and then fell insensible. Her breathing was stertorous, pulse feeble and rather slow, pupils contracted and fixed. She remained insensible for ten hours, then complained of burning in the fauces, œsophagus, and stomach. Vomiting and purging of an offensive fluid succeeded, with burning pain at the epigastrium. The thirst was insatiable; pulse 100. In thirty-six hours she died suddenly, with a congested state of the face, and liquid filling her mouth and nostrils. The mucous membrane of the stomach was found softened, and reddened in streaks. The blood was fluid. There were no other lesions.[1]

In another case, reported by Dr. Bain, a female took a wineglassful of chloroform mixed with water. Four hours and a half afterwards she lay insensible, the countenance pale, the pupils contracted, and but slightly influenced by light, the pulse 84, and moderately full, total insensibility of every part; breathing abdominal, no stertor. Vomiting was produced by the stomach-pump, and stimulants were applied to the skin. In eleven hours consciousness had returned, and with it great complaint of gastric distress. Death from gastritis took place on the eighth day. The mucous membrane of the stomach was red, softened, and eroded, especially near the cardia, and ulceration was found near the pylorus. The lungs, heart, and œsophagus were healthy.[2]

The phenomena produced by inhaling chloroform do not differ essentially from those that ether occasions, but they are more strongly marked. The stage of excitement seldom occurs during the inhalation of chloroform for surgical purposes, and is always extremely brief. In some of the experiments of Dr. Hughes Bennett, laughter and extravagant gayety and humorous gesticulations, accompanied with sensations of a highly pleasurable description, were produced by small doses of the vapor, symptoms, in fact, identical with those which the inhalation of nitrous oxide gas has rendered familiar. Like this agent, also, chloroform sometimes develops, in persons of the coarser sort, a furious pugnacity. But whatever tendency to such manifestations may exist under the first impression of chloroform, as commonly employed, it is speedily and completely subdued by the rapid encroachment of the anæsthetic state. The gradation of the symptoms has been accurately described by Simpson, Snow, and many others. After the first two or three full inspirations a feeling of warmth and excitation is experienced, radiating from the chest to the extremities, followed by whirring noises in the ears, a sensation of vibratory thrilling and numbness throughout the body; with, at times, a rapid loss of sensation and of motion, and, at last, of consciousness. In the

[1] Philadelphia Med. Exam., Nov. 1856, p. 659.

[2] Lancet, April, 1850, p. 400. More recent cases are those of FRICKE, Phila. Med. Times, i. 276; BUSEY, Am. Journ. of Med. Sci., Oct. 1872, p. 430.

first part of this stage sensibility may be blunted while consciousness remains, particularly if the vapor be inhaled very gradually. For the greater number of minor operations, and for obstetric practice, unless when it is intended to arrest powerful uterine action, the degree of anæsthesia produced at this stage is sufficient. So complete may the loss of sensation be, without the consciousness being impaired, that, as Dr. Snow states, he has seen a child unconsciously handling its toys all the time that the operation of lithotomy was performed on it. Commonly, however, the use of the knife occasions expressions indicative of pain, which are either not remembered, or are recollected as having occurred in a dream. It is certain, says Dr. Snow, that chloroform may prevent pain in two ways, either by rendering the mind unconscious of external impressions, or by removing the sensibility to these impressions, that is, by a true anæsthetic action; but usually, and always when breathed in a full dose, it acts in both ways at once. The patient sometimes supposes that he remembers all the particulars of the operation, although he did not feel the pain; but, on questioning him, it is usually found that it is a dream which he remembers, and not the actual facts.

During the full anæsthetic sleep produced by chloroform, sometimes no mental action goes on, or at least is remembered; in many others the mind is active, as in dreams. The respiration is usually at first soporose, or, as Meinel describes it, quicker and fuller at first, then slower, and at last almost suspended;[1] the pupil is sometimes natural, in other cases slightly contracted, in others again dilated; the pulse is usually increased both in force and frequency at first, and afterwards falls nearly or quite to its normal rate; even if the vapor is exhibited very long, and in very powerful doses, the pulse seldom becomes weaker or falls below the natural standard; the muscles of voluntary motion are in general relaxed; more rarely cataleptic; still more rarely rigidly contracted, as happens also occasionally with ether.[2] This phenomenon is most usual in active and robust persons. In females, spinal symptoms are most apt to occur, the unconsciousness being sometimes accompanied by sighs, sobs, partial rigidity of the arms, more or less excitement, and a group of phenomena usually donominated hysterical.[3]

The extensive and careful experiments of Mr. Nunneley led him to a singular conclusion in regard to the *modus operandi* of chloroform. From the possibility of producing local anæsthesia, and from the more rapid action of the vapor through the lungs than through the stomach, Mr. Nunneley concluded that the primary and direct action of the vapor is upon the nerves. He appeared to believe that the anæsthetic influence is propagated through these organs, whereas it is conclusively proven by his own experiments, taken in connection with those that demonstrate the rapid entrance

[1] CANSTATT, op. cit., 1849, p. 184.
[2] Month. Journ. of Med. Sci., viii. 416. [3] Dr. BENNETT, ibid., p. 540.

of anæsthetic vapors into the bloodvessels, that it is through these channels that the vapors are brought into contact with nervous trunks and centres. A very conclusive experiment upon this subject was performed by M. Coze, of Strasburg. He states that a limb can be protected from the influence of chloroform inhalation, by merely compressing the main artery that supplies it. Immediately on removing the pressure, and restoring the circulation, the limb becomes insensible.[1]

The superiority of chloroform over ether, as a rapid and effectual anæsthetic, caused the latter agent to be in a great measure abandoned by surgeons and accoucheurs in Europe; but the fatal consequences which so often resulted from the employment of chloroform gave a shock to the conscience of the profession, which has led to a more circumspect use of it. We believe that surgeons are more solicitous than they formerly appeared to be to learn, from persons more competent than their special vocation permits them to become, whether the patient is or is not affected with a disease or constitutional peculiarity which should forbid the use of chloroform. One portion of the risk may thus be mitigated; but neither this precaution nor any other can avert the danger which appears to be inherent in chloroform, and to be greatest precisely when the necessity of resorting to anæsthesia is least urgent—that is to say, in operations which are trivial in severity as well as of brief duration.

As early as 1850 not less than forty-eight cases of death from chloroform had been published. During 1852 sixteen fatal cases were published, of which eight occurred in the United States and six in Great Britain, and four of them after the simple operation of extracting a tooth. In 1853 Mr. Crisp collected forty-two cases of recorded deaths from this agent.[2] In February, 1857, Mr. Holmes gave fifty as the total number of deaths from chloroform in surgical operations;[3] after which time we found eighteen similar cases in the medical journals, and in a single one, for the first half of the year 1859, not less than seven cases.[4] Yet, just before Dr. Snow's death, in June, 1858, this gentleman stated the number of fatal cases at fifty. From 1858 to 1864 at least fifty additional cases of death by this agent were published. All of the summaries of such deaths professing to be complete are really very imperfect. Thus, in the voluminous treatise of MM. Perrin and Lallemand, printed in 1863, a synoptical table is given of seventy-seven sudden deaths during anæsthesia from chloroform, in which four are set to the account of America. Yet in 1861 Dr. C. T. Jackson published a table containing nine such cases which had occurred in this country alone, not one of which is included in the foreign list. In 1864 the list published by a committee of the Medico-Chirurgical Society of London contained one hundred and nine cases; two years later Sabarth swelled it to one hundred and nineteen, and at

[1] Annuaire de Thérap., 1850. p. 39.
[2] Lancet, June, 1853, p. 523.
[3] RANKING's Abstract (Am. ed.), xxv. 222.
[4] Times and Gazette, June, 1859.

the beginning of 1867 Dr. J. C. Reeve announced the dread total at that date to be one hundred and thirty-three. It cannot be doubted that, during the time that has elapsed since this enumeration, the victims have been quite as numerous as in previous years.[1] Mr. J. W. Haward cites thirteen fatal cases as having occurred between 1865 and 1871.[2] If we were to know of all that occurred without having been published, and in rural districts as well as in towns where such events are eagerly seized upon by the agents of the press, we should have, in all probability, greatly to extend the melancholy catalogue. To give a single illustration of the correctness of this remark, M. Barrier states that five deaths from the inhalation of chloroform had, to his knowledge, taken place at Lyons, and that *one* only was published.[3] Dr. B. W. Richardson[4] made careful inquiries at the greater number of the provincial hospitals in England, noting the number of administrations of chloroform and that of the deaths which followed them. He had thus enumerated 17,000 cases without meeting with a single death. Yet subsequent experience in the very same institutions showed a mortality from chloroform of one in every 1250 cases; and, taking the whole series of cases together, the mortality was one in every 3065 cases. But Dr. R. concluded "that one death in 2000 or 2500 administrations would be nearer the truth; but even at this rate, *we have no remedial agent which approaches chloroform in point of danger*." According to Professor Morgan, of Dublin, "chloroform is eight times more dangerous than ether," and he quotes the allegation that the deaths from chloroform amount to at least one every week. These statements, and many more similar ones, indicate that what we have predicted in earlier editions of this work has come to pass, and that the conscience of the medical profession is making its voice heard in protests against a danger to life which neither necessity nor reason justifies.

[1] Dr. REEVE (*Am. Journ. of Med. Sci.*, Oct. 1867, p. 324) classifies as follows the one hundred and thirty-three cases of death from chloroform which are alluded to in the text:—

I. *Thirty-three* cases in which the report is so imperfect that a judgment cannot be formed as to the manner of death, or as to the share chloroform had in producing it.

II. *Three* cases in which a severe operation was performed, and in which, therefore, chloroform had but a share in producing the fatal result.

III. *Eleven* cases during administration to patients laboring under delirium tremens, or who were hard drinkers.

IV. *Sixteen* cases in which the patient died from the shock of suddenly inhaling chloroform vapor too little diluted, and *nine* cases of shock from surgical procedure.

V. *Twenty-eight* cases in which some of the conditions of safe administration were neglected.

VI. *Thirty-three* cases in which every precaution seems to have been observed, and no explanation of the death can be given in the present state of our knowledge.

It is not asserted that any of these patients would have died at the time and in the manner of their actual death without the inhalation of chloroform; and, therefore, however interesting and instructive may be the analysis which has been given above, the truth remains in all its hideous nakedness to warn us of the dangers of this anæsthetic, and incite us to redouble the precautions which usually surround its administration.

[2] Med.-Chir. Trans., 2d Ser., xxxvii. 13.

[3] Lancet, Aug. 1857, p. 225.

[4] Lancet, March, 1870, p. 518.

It is true that of the fatal cases a portion may be set to the account, in part at least, of other causes than chloroform inhalation, such as the debility, alarm, or diseased condition of the patients. Berend, indeed, who published the first collection to which reference is here made,[1] admits eleven cases only as direct and unequivocal instances of death by chloroform; but it seems impossible to deny the not less real, although less immediate, fatal influence of this agent in nearly all of the remaining examples. It is also true, as charged by Dr. Nunneley, that "even in those cases which have come to light, all sorts of explanations, and attempts to explain away the true cause of death, have often been attempted, rather than admit the fact of the person having been killed by chloroform."[2] But an examination of the published reports must convince any one that in very nearly all of them death was owing rather to some individual susceptibility to the action of the vapor than to the mode in which it was inhaled. The fatal consequences which have been alluded to seem to have made no permanent impression upon medical men. As one of the historians of the subject remarks, the effects of the agent were studied like those of an ordinary medicine; indications and contraindications were laid down, and rules given for its use; experiments on its physiological action and its mode of administration were performed. An exclamation of terror was no longer heard when patients perished suddenly under its inhalation, but the circumstances of the fatal event were discussed as subjects of scientific interest, and the causes of death sought for in the liquid itself, and in its relations to the living organism.[3] It is a doubly melancholy fact that a large proportion of deaths by chloroform have taken place, not during capital operations in which the administration of an anæsthetic was justified by the apprehension that the patient would sink under the shock of pain, but on occasions when the pain to be inflicted by the surgeon could only have been slight, or, if severe, momentary. In the list of fifty cases published by Dr. Snow, there is not a single instance of a capital operation, and in twenty-four of them the patient perished before even the intended operation had been commenced. In one case a healthy-looking girl of fifteen, affected with strabismus, died in the surgeon's hands when the operation was hardly begun.[4] In Mr. Haward's report, above referred to, the operation is stated in ten cases, and in not one of them did it belong to those which usually endanger life. Time has afforded no grounds for modifying the statements or qualifying the opinions which are here expressed; on the contrary, it has confirmed them all, and intensified our amazement at the reiteration of the same dismal or shocking details without any sign of conscious guilt, or any evidence of remorse, upon the part of those in whose hands human life has been wantonly sacrificed.

The causes of death are regarded very differently by different

[1] Chloroform Casuistik, Hannover, 1850.
[2] Op. cit, p. 319. [3] CANSTATT, 1851, p. 95.
[4] Times and Gazette, June, 1859, p. 581.

observers. Stannelli[1] maintains that asphyxia is the fatal agent, and may operate in either of several modes: 1. The vapor being administered in too concentrated a form, excludes the atmospheric air, or supersaturates the blood so that it no longer acts as a natural stimulus to the system, or else it occupies the place of the blood in the vessels, and so paralyzes the heart. 2. The system being overcharged with the vapor, its normal actions proceed imperfectly and irregularly, and death is the result. 3. The respiration is impeded by mucus at the entrance of the larynx, or else by a too close application of the respirator to the mouth and nose. It is chiefly upon the last of these propositions that Stanelli dwells, but it is of questionable soundness; for, as has been asked by Berend, is not mucus or saliva that has reached the glottis always swallowed? Why, if this be the cause of death, are not the fatal cases more numerous? and why, above all, is not this mechanical impediment found after death? To which objections may be added the more weighty one that the mode of death is seldom like that by suffocation either in the rapidity with which it supervenes, or in the phenomena which accompany it. A review of the fatal cases furnishes a very uniform result, and shows but few symptoms as precursors or concomitants of death. In a very small number more or less twitching of the muscles of the face and extremities, and in two or three instances spasmodic contraction of the muscles of the posterior part of the trunk, have been noticed; but, in general, the breathing grows feeble and infrequent, the pulse small and faint, and the face pale and cold. In a smaller proportion of cases the features are congested instead of pallid, and in these the respiration is more or less stertorous, and there is sometimes foam upon the lips. The former group of cases seems to indicate a direct poisonous action of the chloroform, while in the latter are *superadded* the effects of an exclusion of atmospheric air—the signs, in other words, of asphyxia.[2]

The condition which precedes, and is the cause of death by chloroform, is regarded by Mr. Snow as a paralysis of the heart. In nearly every fatal case, the right cavities of this organ are found distended with blood which had so impeded its action as to produce a more or less sudden, but always a rapid, extinction of life. Death, in fact, takes place by *syncope*, which is a more or less sudden and complete loss of sense and motion, and may be produced by any cause which arrests the cardiac circulation; by the withdrawal, *e. g.*, of the nervous power on which the movements of the heart depend, and which may coexist with emptiness of the heart on the one hand, or its congestion on the other. From the symptoms observed in death by chloroform, and which are above described, it may be inferred that the former of these causes is less frequent than the latter. Dr. Glover is of opinion that the tetanic spasms in some

[1] Was ist der Chloroformtod, etc.? Berlin, 1850.

[2] Consult also GOSSELIN, Arch. Gén. de Méd., 4ème sér., p. 385; Drs. SIBSON and SNOW, quoted in Am. Journ. of Med. Sci., July. 1849, pp. 274 and 278; BRAITHWAITE'S Retrospect (Am. ed.), xvii. 306; ROBERT, Bull. de l'Acad., xiv. 1091; ORFILA, op. cit., ii. 714.

cases, and epileptiform convulsions in others, show a direct poisonous action of the vapor upon the brain and the spinal cord.[1] Dr. Kidd regards paralysis of the respiratory muscles with spasm of the glottis as the first step in death by chloroform; the second as engorgement of the pulmonary veins, and of the right side of the heart. But this mechanism would produce asphyxia, not syncope. Sabarth[2] found only 48 out of 119 published cases, in which the cause of death could be clearly determined. Of these cases 36 perished by asphyxia, 11 by syncope, and one by spinal apoplexy. Not only are the direct and immediate effects of chloroform of a pernicious tendency, they are so far cumulative as to betray their poisonous qualities even after its inhalation has ceased. Dr. Snow observed the insensibility to increase for twenty seconds after the inhalation had been left off, and unless, therefore, extreme precaution is observed in administering the vapor, a deadly dose of it may be given before any sign of danger is betrayed.

The above considerations furnish a reason why the use of chloroform as an anæsthetic should be avoided in those affections of the lungs which predispose to asphyxia, and in those conditions of the heart and blood which favor the production of syncope. The shock of severe accidents, mental excitement or depression, constitutional or accidental debility are, therefore, so many contraindications to its use, but they present less serious obstacles to the employment of sulphuric ether. Dr. Warren presents, in a few words, the comparative merits, in surgery at least, of these two anæsthetics when he says, "Ether is generally safe; chloroform cannot be said to be safe in any case, . . . no practitioner can be reasonably assured in his own mind that it will not prove fatal the next time he employs it." But *if the consideration of danger be left out of the comparison*, there can be no question of the superiority of chloroform to ether as an anæsthetic. Its advantages may be thus summarily stated, after Speyer,[3] Simpson,[4] and others: 1. A less quantity of chloroform than of ether is requisite to produce the anæsthetic effect. 2. Its action is more rapid and complete, and generally more persistent. 3. Its influence is far more agreeable. 4. Considering the quantity used, it is much less expensive. 5. Its perfume is pleasanter, and less adherent to the clothing, etc. 6. It is much less inflammable, and may, therefore, be more safely employed by night. Unfortunately, the "consideration of danger" is that precisely which we are under the strongest obligations to regard. If a remedy is dangerous, we are morally bound not to use it, unless withholding it involves a greater danger still. If the degree of anæsthesia necessary for a due performance of the graver surgical operations is such as to imperil life, and that, too, without any possibility of anticipating and guarding against the danger, the surgeon who employs it assumes a responsibility of life and death, for which neither his office nor the moral law affords him any license.

[1] Lancet, Nov. 1858, p. 469.
[2] Das Chloroform, 1866.
[3] CANSTATT, op. cit., 1849, p. 184.
[4] Lancet, Nov. 20, 1847, p. 549.

Prolonged experience has served to confirm the conclusions which have just been given, and which may be thus summarily expressed: Ether is capable of fulfilling the same indications as chloroform without exposing to the same danger. In 1859 the Medical Society of Lyons declared, after a full discussion of the subject, that ether is less dangerous than chloroform; that anæsthesia may be produced by the former as constantly and completely as by the latter; that if the embarrassment attending the administration of ether is greater, it is still not to be compared with the positive dangers inherent in the use of chloroform; and, consequently, that the preference ought generally to be given to ether over chloroform.[1]

Now, if we consider the minute precautions which are enforced by those who, like Dr. Snow, have had the largest experience in administering chloroform; the abandonment or rejection of it by a large number of the most experienced and judicious surgeons in the United States, and by many in Europe; the fact that, besides the absence of all outward sign to indicate whether the patient is fit or unfit for the use of chloroform—for in some cases the fatal effect is produced by an exceedingly small dose—and that the danger bears no proportion at all, or, if any, an inverse proportion, to the severity of the operation, it must be admitted that the question whether its use as an anæsthetic in surgery should be persisted in, is one of extreme gravity, and which it is more than probable will ultimately be decided in the negative. Meanwhile, it cannot be denied that chloroform has been administered thousands of times, in almost every description of surgical operation, and, apart from the comparatively rare exceptions above noticed, without any evil result. Yet it is probable that ether would have secured all the advantages, with few, if any, of the dangers which attach to chloroform; and when it is considered that the chief danger is nothing less than the destruction of human life by the very hand which is professedly endeavoring to save life, the question becomes one of such gravity that it should be decided in the court, not of science, but of conscience and morals.

Other consequences than fatal ones, but still seriously to be deprecated, have been observed to result from the use of chloroform. One of these is the circumstance that during the stage of excitement, or even of imperfect insensibility, it prompts to expressions and movements which betray sexual propensities, particularly in females; and although it has been alleged that such exhibitions have usually occurred in the case of dissolute individuals, the fact is not exclusively so. The objection, also, such as it is, applies with even greater force to ether than to chloroform. Still, it does not follow that, on this account, the benefits of the medicine should be withheld from the great mass of those to whom, on general

[1] Annuaire de Thér., xxi. 44. For a long time the dangers in question were unheeded, but recently several writers have urgently called attention to them, among others Dr. J. Morgan, of Dublin, in a work entitled "The Dangers of Chloroform, and the Safety and Efficiency of Ether, etc." London, 1872.

grounds, it is appropriate. Sickness of the stomach has been observed in many instances after the inhalation of chloroform, but it has generally been produced when the vapor was exhibited immediately after a meal, or, on the other hand, after long fasting. In the latter case it has, in some instances, been of considerable duration, and accompanied with more than usual depression (*Snow*). It may generally be checked by a little brandy and water, or an opiate. A more common but remote effect of chloroform is headache, with a sensation of giddiness, and excitement or general nervousness which has, in some cases, been perceived even for months after the inhalation. Dr. Happoldt has published the case of a person who, for the relief of asthma, inhaled chloroform to the extent of twenty ounces in forty hours. The attack was cured, but the sense of smell was abolished, and that of taste perverted. The bladder and rectum were paralyzed, the latter remaining torpid for several months. The sexual appetite was for many weeks abolished. In a second case by the same physician, four ounces of chloroform were inhaled. Consciousness was suspended for ten hours. For more than a month ordinary articles of food lost their proper savor; the sense of smell was for the same period nearly abolished, and the nostrils nearly closed by the swelling of their lining membrane. As in the other case, the bladder and rectum were torpid, and erections of the penis were impossible.[1] The most serious of the secondary consequences attributed to the inhalation of chloroform, is the production of insanity. Four or five cases of this nature are related by Dr. Webster, of London;[2] they all occurred, however, after parturition, and may, therefore, not without reason, be suspected of being ordinary examples of puerperal mania. The only case which affords any real grounds for the charge alluded to, is the following:—

A female, 20 years of age, inhaled chloroform for the purpose of having a tooth extracted. She recovered apparently from its influence, and walked home, a distance of a quarter of a mile. Her conversation was incoherent, and her gait unsteady. Soon afterwards she lost both sense and motion, the skin was cold and pale, the respiration jerking, and the pulse feeble; no rigidity of the muscles. She came out of this state and then became "furiously insane." There was constipation with deficient urine. This condition lasted for a week or ten days, and then her usual health was restored.[3]

Uses. *In Surgery.*—Little need be added to what has been said under the head of ether, respecting the inhalation of chloroform in surgery, except to qualify the statements there made, by suggesting the necessity of greater caution in using the latter agent. Its advantages consist in the rapidity and durability of its influence, and the comparative absence it insures of those symptoms of excitement which hinder the surgeon in the execution of his duties.

[1] Charleston Med. Journ., xi. 60. [2] Psychological Journal, iii. 269.
[3] Dr. E. H. CLARKE, Boston Med. and Surg. Journ., Feb. 1855, p. 84.

In operations upon *infants and young children*, M. Guersent,[1] whose vast experience carries with it an acknowledged value, regards the employment of chloroform as of incalculable importance. By its means the resistance of the patient, which under ordinary circumstances, offers so serious an obstacle, is completely overcome, and the operation is performed with singular rapidity and ease. This is strikingly the case in operations for stone. Dr. Keith[2] considers that anæsthesia greatly augments the feasibility and success of *lithotrity* in young persons, and indeed renders it easy, when without this aid it would be impossible. It is fortunate that death from chloroform inhalation is almost unknown in surgical operations upon children. Dr. Snow states that he administered chloroform in 155 cases of lithotrity and 91 of *lithotomy*.

In respect to its usefulness in *ophthalmic surgery*, opinions are divided. Jüngken[3] regards it as eminently serviceable in persons of an irritable temperament; when the eyes have become morbidly sensitive to light, so that the lids and muscles of the ball contract spasmodically; when the patient, from having been born blind, or from other causes, is unable to control the movements of the organ; in infants and children, generally, for operations that involve the eyeball, or for the mere extraction of foreign bodies from the surface of the conjunctiva; in all long and painful operations on the eye, such as the extirpation of tumors, etc. As in several operations, the ball must be firmly fixed, it is necessary to counteract the mobility of the organ, which the anæsthetic state increases, by steadying the ball with the same finger which depresses the lower lid.

It is maintained, on the contrary, by several ophthalmic surgeons, and by Mr. Wilde, of Dublin,[4] among others, that anæsthesia impedes operations upon the eye because the active co-operation of the patient is thereby prevented. In that for strabismus, for instance, it cannot be known whether the contracted muscle is divided or not; in extraction of cataract the patient cannot give the globe of the eye a proper inclination, etc. Besides, according to Mr. W., there is a danger of convulsions which must prevent all operation, and the slight degree of pain usually required to be inflicted renders anæsthesia unnecessary. These objections do not, as will be seen, destroy the force of Jungken's recommendations, which are addressed to cases of daily occurrence, less than to such as on account of the age, or the susceptibility of the patient, are surrounded with difficulties which impede the due performance of an operation, if they do not entirely prevent it. It is believed, however, that the preference of ophthalmic surgeons for chloroform is decided. Mr. H. Walton has pointed out its advantages in detail, and represents them as very great. The straining of the eye which has sometimes occurred during the vomiting which is apt to follow anæsthesia, he obviates by means of an appropriate

[1] Bullet. de Thérap., xxxvi. 50.
[2] Month. Journ. of Med. Sci., ix. 662.
[3] Annuaire de Thérap., 1852, p. 69.
[4] CANSTATT, op. cit., 1849, p. 189.

pad and bandage over the affected organ.[1] Dr. Snow refers to a large number of cases in which this agent was employed in operations for cataract, *strabismus*, *extirpation of the eyeball*, *the removal of foreign bodies*, *entropion and ectropion*. To these may be added cases of extraction of foreign bodies from the *nasal passages*, the *auditory canal*, the *vagina* and *rectum*.

It is unnecessary to pursue any further a description of the dif ferent operations which have been performed with the assistance of chloroform. Suffice it to say that there is none in which it has not been invoked, from the most serious or difficult, such as lithotomy, amputation of the thigh, extirpation of tumors, plastic and vesico-vaginal operations, and the reduction of dislocations or of herniæ, down to the most trivial, such as the extraction of teeth and tenotomy. Its advantages are that by preventing pain it renders many operations easy, as in children, which were otherwise impracticable, either on account of the severity of the pain or its duration, and it induces many persons to submit to necessary surgical treatment with cheerfulness and tranquillity who would, under ordinary circumstances, have refused the interference of the surgeon altogether, or been seriously injured by the pain itself or the apprehension of it. How far it influences the rate of mortality after capital operations is a question still undecided, or rather which has been decided differently by different investigators. While Dr. Simpson, Dr. Snow, and Mr. Fenwick,[2] alleged an increased success of the operations performed since the introduction of anæsthetic agents, which, however, they do not attribute solely to their influence, Dr. Arnott assigns "chloroform as the cause of the great increase of mortality after the severer operations, from its having proved itself a virulent poison, by the numerous sudden deaths that have followed its administration, from the great and lasting prostration that is so often produced by it, and particularly from the frequent observation that this prostration and other allied symptoms have continued until the death of the patient."[3] Dr. Arnott maintains further that "an increase of mortality after amputation and lithotomy has occurred since the introduction of chloroform, to the extent of *twelve* per cent. as regards the first of these operations, and *twenty-four* as regards the other."[4] It thus appears that gentlemen of equal probity and sagacity are at issue in regard to a question of fact. The one party affirms and the other denies with equal emphasis and conviction. The clinical records of other countries than England do not throw any light upon the question, for the mortality attributed to chloroform elsewhere is so slight that in the whole of Europe Dr. Snow could discover but twelve cases against thirty-eight in the British possessions and the United States of death from this agent.

It is to be observed that in the continental countries of Europe

[1] Times and Gaz., Jan. 1855, p. 79.
[2] Ibid., 1857, ii. 539, 592, 641.
[3] Ibid., May, 1857, p. 495.
[4] Ibid., Jan. 1859, p. 55.

the mode of administering chloroform differs from that which prevails in England, in this, that the state of anæsthesia is less profound and complete, and therefore unattended with the same phenomena of narcotism. Even when an equal or a larger amount of the vapor is administered, its action is less concentrated and intense, and we consequently find that French and German surgeons dwell more upon its consecutive than its immediate dangers. Thus it is that M. Chassaignac speaks of these effects occurring from sixteen to forty-eight hours after the operation, the injury to the vital forces by the chloroform being so profound that the patient is unable to recover from it. In the Crimean campaign, we are informed by Medical Inspector Dr. Scrive, that in no single instance of thousands of cases was the administration of the anæsthetic the cause of the least accident of a serious nature, but he attributes this immunity to the fact that it was never allowed to produce complete muscular resolution.[1] M. Baudens, also, in his account of the campaign in the East, asserts that, although chloroform had been employed thirty thousand times in the French army there, no fatal accident had ever resulted from its use. But Dr. Rizet, of the Chasseurs, denies this, and cites two cases that occurred under his own observation,[2] and Deputy Inspector-General Mouat, of the British army in the Crimea, charges it with being a cause of death under the same circumstances precisely as those pointed out by M. Chassaignac. "A peculiar state of nausea and depression," he remarks, "follows its use, in which perfect reaction is never thoroughly established, the desire for food never returns, and the patient sinks, as it were, stealthily, and dies from exhaustion, in from twelve to twenty-four hours."[3] With these evidences of the primary and consecutive evils which chloroform may induce as an anæsthetic in the practice of surgery, we are justified in once more repeating the suggestion that its continued employment involves very serious considerations of a professional as well as of a moral nature.

In Midwifery.—The first cases of midwifery in which chloroform was employed were reported by Dr. Simpson[4] and Dr. Protheroe Smith.[5] Immediately afterwards its use became general in Great Britain. Some of the older obstetricians, however, opposed the new agent, and continued to be unfavorable to its use. Indeed, it is believed that the profession generally are much less addicted to its employment than was the case a few years ago. We shall take a survey of the facts and opinions which are recorded in reference to the use of chloroform during pregnancy and labor, and after confinement.

Chloroform has been administered by inhalation to allay the *vomiting of pregnancy*, which, it is well known, sometimes reaches an alarming and even fatal degree. M. Cazeaux was, we believe, the first to make this application of the medicine, and to announce

[1] La Campagne d'Orient, pp. 465 and 468.
[2] Times and Gaz., May, 1859, p. 485.
[3] Ibid., Aug. 1856, p. 225.
[4] Lancet, Nov. 20, 1847.
[5] Ibid., Nov. 27, 1847.

its complete success in a very desperate case.[1] By the stomach, chloroform has proved successful under these circumstances, as it has in several others of obstinate vomiting produced by various causes. The full narcotic effect of the vapor has been known to produce miscarriage. Such a case is related by Dr. L. G. Robinson as occurring in a robust lady, pregnant with her third child. She inhaled chloroform for the relief of a slight toothache, but fell into a semi-conscious and anæsthetic state, in which labor commenced.[2]

During labor, chloroform, when propitious in its operation, diminishes or prevents all of those evil consequences which depend directly upon the patient's suffering. Among these one of the most formidable is *convulsions*. In so far as they result from the severity or the prolongation of uterine efforts they may be with great certainty averted. When this suffering occasions great restlessness and irritability, and an alarm respecting the issue of the confinement, there is sufficient reason to apprehend epileptiform convulsions, and chloroform is the speediest remedy. This condition is to be distinguished from hysteriform excitement, which anæsthetics are more prone to aggravate than allay. If the convulsion depends upon advanced granular degeneration of the kidney, chloroform can be of little avail; but albuminuria and dropsy, to a considerable extent, may be present without any such anatomical lesion, and therefore the remedy should in no case be withheld. It occasionally happens that the sensibility of the generative organs is morbidly acute, so much so that the slightest manual interference on the part of the accoucheur, the progress of the child, or any instrumental manœuvres cannot be borne, or they give rise to extreme agitation, anguish, and exhaustion. Chloroform at once removes every obstacle to the free action of the medical attendant, and spares the patient incalculable distress.

The influence of chloroform upon the *uterine contractions* is not always the same, although it generally depends upon the dose that has been administered. Yet we are assured by some that the ordinary average dose sometimes suspends uterine action altogether,[3] while the greater number of physicians find that in this dose the anæsthetic tends rather to render irregular contractions regular without at all diminishing their energy, while it produces a general calmness and composure in the highest degree propitious. It is very true that when chloroform is first administered, especially to a patient who is apprehensive of its effects, her pains may cease or become irregular, as they might do under any mental impression. This is a phenomenon made familiar by daily experience. It is, however, true that apart from such mental influences, a diminished expulsive effort is occasionally met with as the direct effect of the action of the vapor. Dr. Robert Lee has taken advantage of the fact to charge against chloroform that "it very manifestly slackens the uterine contractions, and in some cases puts a stop to them

[1] Abeille Méd., x. 183. [2] Edinb. Med. Journ., iii. 268.
[3] DANYAU, Bull. de Thérap., xlvi. 534.

altogether."[1] This effect is admitted by Dr. Rigby, who, however, pronounces it to be very rare,[2] and by Spiegelberg, who asserts that no one has seen such effects when the anæsthetic was properly administered. The voluntary activity of the abdominal forces, he contends, may disappear, but the involuntary action remains unimpaired.[3] This also is the view taken by Dr. Murphy.[4] He calls attention to the double motive power of the uterus, the reflex and the ganglionic. The former of these may be suspended by the anæsthetic influence, but the periodical and expulsive uterine efforts, it is said, will continue under the action of the ganglionic system of nerves.

The practical fact is, however, well settled that the precise action of the vapor cannot always be anticipated. As Dr. Snow has observed, in some cases the chloroform, even when very moderately employed, diminishes both the strength and the duration of the uterine contractions, and prolongs the interval between them. In other cases the inhalation causes the uterine action to become stronger and more regular, by removing the excess of sensibility by which it had been interfered with. In some cases, also, says Dr. S., "chloroform seems to act as a direct stimulant to the uterine contractions, increasing their force and frequency—a circumstance at which we need not be surprised, when we remember that both opium and brandy, in moderate quantity, often act in the same manner."[5] These different effects of a cause apparently the same must, we presume, be attributed, in part, to the unequal sensibility of different patients to the operation of chloroform, and still more to their intolerance of pain, whether this depend upon constitutional peculiarities, and particularly upon a high nervous excitability, or upon casual physical conditions, such as rigidity of the os uteri or other soft parts of the mother, or upon an undue development, positive or relative, of the child's head. Another cause of the different reports upon this subject by obstetricians is undoubtedly the difference of the doses of the anæsthetic administered. The effects of the same dose cannot be regarded as absolutely the same even for the same patient at different times, under different degrees of suffering, excitement, etc., and still less are they alike for different patients. But we believe it may safely be held that a moderate dose will promote, and a large one retard, uterine action, whenever the uterus itself retains its contractile power.

The influence of chloroform on the *sequelæ of natural labor* deserves to be considered in estimating the value of anæsthesia in obstetrics. It cannot be denied that of all pains the throes of childbirth are those from which recovery most speedily takes place. Nothing is more common among robust women of the laboring classes than for the strength to be but moderately impaired, even by a severe labor.

[1] Lancet, Dec. 1853, p. 609; Times and Gaz., Sept. 1854, p. 260.
[2] Times and Gaz., Sept. 1858, p. 306. [3] Ibid., March, 1859, p. 244.
[4] Lancet, Feb. 1856, p. 129; Chloroform in Childbirth, p. 17.
[5] Chloroform and other Anæsthetics, p. 324.

This is met with habitually when the labor has been short, however severe it may have been, and frequently after a protracted and painful parturition. But in females more delicately organized, or whose luxurious habits of life have induced a morbid susceptibility of the nervous system, the restoration of strength and comfort is often extremely tedious and uncertain. Under such circumstances, the employment of an anæsthetic is frequently of signal service, for it palliates, even when it does not neutralize, the effects of pain, and protects the system from that "shock" which in surgery is justly accounted one of the most formidable elements of every severe operation.

Dr. Robert Lee ranks *hemorrhage* among the evil effects of chloroform in labor, and Mr. Steele makes a similar statement, but adduces only a single case in its support.[1] Dr. Duncan and also Dr. Kidd advise that in cases where it is apprehended after an application of the forceps, the operation should be preceded by the administration of ergot,[2] and Dr. Rigby, without, however, a direct reference to this accident, but rather with a view to obtain the aid of the abdominal muscles in the expulsion of the child, advises that the operation of the anæsthetic should be partially suspended while the fœtus is passing through the external parts of the mother.[3] On the whole, we think that the general sentiment of obstetricians now is that uterine hemorrhage is more likely to occur after the abministration of chloroform than when it has not been employed.

In some *obstetrical operations*, such as replacing the prolapsed cord, and the application of the forceps at the lower strait, the aid of chloroform is usually unnecessary; but it is recommended by the best authorities when craniotomy is to be performed, when the forceps are to be applied at the superior strait, and especially in the operation of turning, if the contractions of the uterus are sufficiently strong to interfere with its due execution. It should not be administered if uterine inertia exists. The delivery of the placenta retained by an hourglass contraction is singularly facilitated by this agent.

Some years ago, Dr. E. W. Murphy published certain conclusions which we here insert in a somewhat abridged form, as expressing substantially the present state of opinion on this subject.

"1st. That chloroform does not impair the contractile power of the uterus, neither does it interfere with the action of the uterus, unless it be given in very large doses, or that the patient be highly susceptible of its influence.

"2d. That the full anæsthetic power of chloroform may be produced without paralyzing the uterus. The moment the chloroform is withdrawn, the uterine contractions instantly return with increased force and efficiency.

"3d. In every case where the patient had previously suffered agonizing pains, and her labor was making an unfavorable progress,

[1] Liverpool Med.-Chir. Journ., No. III. p. 45.
[2] Edinb. Med. Journ., ii. 803.
[3] Times and Gaz., Sept. 1858, p. 307.

chloroform has produced a most salutary change in restoring the proper action of the uterus.

"4th. Those effects that indicate want of power in the uterus, viz., great protraction of labor, hemorrhage, retained placenta, etc., have not been proved to be the results of chloroform.

"5th. That degree of the etherization which moderates the intensity of pain without interfering with consciousness, does not interrupt the action of the uterus.

"6th. The safety of the child *is not* hazarded by the administration of chloroform."[1]

The third of these propositions may be still further extended. When pains are rendered inefficient by the prolonged suffering of the patient, or by any mental impression, such as fear, anxiety, or impatience, the inhalation of chloroform calms the nervous agitation, refreshes the strength, and restores the contractions of the womb to their normal rhythm, while it augments their energy.

It may now be remarked that there is not a single case on record of death, *during* parturition, from chloroform administered by a competent practitioner of medicine. Two cases are, however, published in which females died while inhaling chloroform administered in the absence of the physician, and without his knowledge or consent.[2] In both, death took place before delivery, and appears to have been sudden. In a third instance, the patient obtained possession of about two ounces of chloroform, which she inhaled by *herself*, in the course of twelve hours. There appears to have been uterine inertia. At the expiration of the period mentioned, there was "a cold sweat, cold extremities, oppressed and wheezing respiration, receding pulse, and vacant glare." *Consciousness was perfect.* External and internal stimulants were employed, but without improvement. At this period instrumental delivery was resorted to, "and in ten minutes the anxious mother was a corpse."[3] A very similar case to this is reported by Dr. Ramsbotham. Chloroform had been administered in the ordinary manner, the child was born, and the patient appeared comfortable. At the end of an hour and a half, however, *distressing dyspnœa* came on; this was followed by convulsions, and almost immediate death.[4] An instance of the same description is recorded by Dr. Murphy, who maintains that in it, as well as in the one last referred to, chloroform was foreign to the fatal result.[5] Now, as dyspnœa was a prominent symptom in every instance, and one which does not characterize any accident of the puerperal state which could have existed in all of the three cases before us, we are constrained to see in them examples of one of the modes in which chloroform destroys life.

These illustrations would be sufficient to show that chloroform in parturient cases is not, as some of its foremost advocates would have us believe, almost, if not entirely, free from danger; "a most

[1] Month. Journ. of Med. Sci., ix. 1247.
[2] Times and Gaz., April, 1855, p. 361; ibid., Nov. 1858, p. 465.
[3] Am. Journ. of Med. Sci., April, 1854, p. 552.
[4] Obstetric Medicine and Surgery, p. 169.
[5] Op. cit., p. 62.

dangerous fallacy," as Dr. McClintock, of Dublin, remarks, "and one that would invariably lead to disastrous consequences, if generally acted on." But besides these fatal cases there are others which convey a serious, if not so solemn a warning. A woman in the Dublin Lying-in Hospital was in her first labor; the os uteri was unyielding, and there was much general irritability. For an hour chloroform was administered in very small quantities, which produced neither anæsthesia nor sleep. About a drachm of it was then poured upon a cup-shaped sponge, which was reapplied to the patient's mouth. Hardly had she taken three or four inspirations when "a change came over her countenance; the eyeballs turned up, the pulse left the wrist, respiration was suspended, and some froth collected at the angles of the mouth." The sponge was instantly withdrawn, the circulation of fresh air promoted, the face and chest were aspersed with cold water, and ammonia was applied to the nostrils.[1] The woman recovered, but every one will agree with Dr. McClintock, that, "had she been in non-professional hands, her life would have been lost." It cannot, moreover, be doubted that other cases of the same nature, in public, and still more in private, practice, have occurred without having been announced through the press.

Not, however, to conceal any fact which may influence the decision of the question of anæsthesia in childbirth, it is proper to add one or two general statements in favor of its employment. Dr. Snow cites but one case in which it destroyed life, the first of those above referred to, and none at all of those in which life appeared to be in danger.[2] Dr. Williamson, of the Royal Infirmary, Aberdeen, writing in 1858, states that since the introduction of chloroform he had been on the look-out for a record of a fatal case resulting from its administration in midwifery, and that hitherto his search had been a fruitless one.[3] In 1859 Dr. Spiegelberg declared to the Berlin Medical Society that as yet no case of death had occurred from its obstetrical employment, and the correctness of his statement was not impugned.[4] Still more recently the President of the Dublin Obstetrical Society stated, that, so far as he knew, no instance was recorded of its injurious or deadly consequences when administered during labor.[5]

Nevertheless, there is reason to believe that we are not acquainted with all of the cases in which the life of parturient females has been sacrificed to chloroform, nor of those in which this agent has placed such persons in imminent danger of death, and it is still more probable that its minor mischiefs may have been unrecognized, even where they have not been purposely concealed. If there is some exaggeration, there is also much truth, in the statements of Dr. Robert Lee, who enumerates as the evils produced by chloroform in midwifery, "exhaustion, hemorrhage, fever and inflammation,

[1] Dublin Quart. Journ., Aug. 1855, p. 192.
[2] Op. cit., p. 328.
[3] Times and Gazette, Oct. 1858, p. 379.
[4] Ibid., March, 1859, p. 244.
[5] Dublin Quart. Journ., Feb. 1863, p. 180.

and cerebral disturbance." Seventeen cases are published by him in some detail. In the first and second of them, he remarks, "The contractions of the uterus were arrested by the chloroform, and delivery completed by craniotomy. Insanity and great disturbance of the functions of the brain followed its use in seven cases; it became necessary to delivery with the forceps in five cases; dangerous or fatal peritonitis or phlebitis ensued after the exhibition of chloroform in four cases. Epilepsy followed in one, and dangerous fits of syncope in another case." In his comment upon this distressing statement, Dr. Lee remarks: "Much reflection on the physiological effects and observation of the pathological mischief of chloroform leave no doubt on my mind that it ought to be altogether expelled from the practice of midwifery. There are no circumstances in which it can be with utility, none in which it can be with safety, employed."[1] Finally, Mr. Robert Johns, of Dublin, reiterates the accusations, and supports them by an appeal to published documents, in even more emphatic terms than any who have written upon the subject. "I am firmly convinced," he remarks, "that chloroform, when inhaled during labor, very fruitfully predisposes to hemorrhage, puerperal inflammation, chest affections, and other diseases detrimental to health and life, which it aggravates if given during their presence. It also lays the foundation of diseases to arise at a more distant period, and thus increases the mortality in childbed and subsequent thereto."[2] Although the publication of Mr. Johns has been branded as "an offence against truth, against science, and against common sense," its essential statements have not, we think, been successfully controverted. With the data before him which are contained in this article, the reader will be enabled to judge for himself how far, if at all, the denunciations of Dr. Lee and Mr. Johns are founded upon the results of experience, the sole permanent and reliable basis of opinion in such a case as the present.

In Various Diseases.—A case of *continued fever* is related[3] in which, when the patient seemed exhausted by delirium and loss of sleep, the inhalation of chloroform was resorted to, and produced tranquillity and refreshing slumber, after which the disease took a favorable turn, and ended in recovery.

Several cases of *tertian intermittent* are reported by M. Delioux, in which a recurrence of the paroxysms was evidently prevented by chloroform, given internally by the mouth a short time before the period of their expected return.[4] Dr. Dalton, of Ohio, states that he has used it successfully to prevent the development of congestive intermittent fever, by administering one or two drachms in a little camphor-water, with half a grain of sulphate of morphia. "In quite a number of cases" of simple intermittent he found that it promptly arrested the disease.[5]

[1] Times and Gazette, September, 1854, p. 257.
[2] Dublin Quarterly Journal, May, 1863, p. 353.
[3] Lancet, 1848, p. 119. [4] Archives Gén., 4ème sér., xxiii. 51.
[5] Phila. Medical Examiner, April, 1856, p. 252.

Wucherer has even recommended the inhalation of chloroform in *pneumonia*. According to him, it relieves the stitch in the side sooner than any other means, particularly if, in robust persons, and when the disease is extensive, venesection has been premised. The cough and oppression are immediately palliated. The inhalation should be employed three or four times a day, and eight or ten drops consumed on each occasion. The same physician used chloroform with advantage in *whooping-cough* and in several form of *bronchitis*.[1] Clemens[2] not only confirms the preceding statements, but extends them. He is of opinion that chloroform both palliates the cough and excitement, and directly favors the resolution of the extravasated fibrin, and prevents the deposit of more; so that it appears to stand in the stead of ordinary antiphlogistic remedies for the disease. Under its use the sputa retain their viscid and tenacious character throughout the attack. The pulse also loses in a remarkable degree its frequency and hardness. To produce such results, repeated inhalations are necessary—as often as from two to twelve times in twenty-four hours—and each time a drachm of chloroform is consumed in the course of fifteen or twenty minutes. In 1852 it was stated by Dr. Simpson that upwards of two hundred cases of pneumonia had been treated by Baumgartner, Helbing, Schmidt, Varrentrapp, and others, with chloroform, and that the aggregate mortality was only 4¼ per cent.[3] More recently Hutawa has also written favorably of its use in this disease.[4] It does not appear that in the class of diseases now under notice any great extension has been given to the practice recommended by the writers just quoted, nor is it likely to be generally adopted in pneumonia, at least if its administration demand such incessant attention as Dr. Clemens prescribes. Yet there can be no doubt that in various pulmonary affections it might serve as a valuable palliative, without being open to the objections which attach to the free exhibition of opiate medicines. It was mentioned above that chloroform had been used in *whooping-cough*. Originally proposed by Dr. Simpson, it has since been employed by other physicians in cases of the disease affecting persons old enough to anticipate the paroxysm, or rather to cut short its development, by inhalations of the vapor. Dr. Churchill has reported several examples of its prompt and decided curative power.[5] A favorable report of its effects has also been published by Dr. Pape.[6]

Diseases of the Nervous System.—It has already been mentioned that chloroform was first used medicinally in 1832 by the Drs. Ives, of New Haven, to palliate affections of a spasmodic type. They found that it afforded very decided relief in *asthma*. Sometimes they employed it by inhalation, and its effects, according to them, were pleasant, as well as palliative of the cough, and heat of skin, if any existed. More recent experience has shown chloroform

[1] CANSTATT'S Jahrb., 1849, p. 190. [2] Ibid., 1851, p. 99.
[3] Month. Journal, Jan. 1852, p. 43. [4] Times and Gazette, May, 1855, p. 499.
[5] Month. Journ. of Med. Sci., August, 1853, p. 180.
[6] Bull. de Thérap., l. 231.

to be one of the most certain and prompt among the remedies for *spasmodic asthma*. It usually procures sleep for the patient, and at the same time puts an end to the attack.[1] Care must be taken, however, not to confound this affection with the paroxysmal dyspnœa which often attends emphysema of the lungs, for in the latter case a bronchitic inflammation or congestion is present, which the vapor of chloroform might seriously aggravate.

One of the most decidedly useful agencies of chloroform is its control over the spasms of *tetanus*, in which it far excels all the narcotics that have been used. Under its influence the muscles relax, the patient regains the control of his limbs, and generally falls into a sound and refreshing sleep, from which he awakes with the symptoms very much modified, if not entirely removed. The numerous cases of success which have attested its efficacy, both when used alone from the commencement, and when given at an advanced period of the attack, after the failure of other means, seem to entitle it to the first rank among the means of combating this dangerous malady.[2] This disease was first treated with chloroform in 1848, by Prof. Forget, of Strasbourg. The case was one of the idiopathic form, and recovered.[3] In the same form it was afterwards used successfully by Baudon,[4] Hergott,[5] and, in a case of trismus, by Harding.[6] Cures of the severest cases of the traumatic form of this disease have been accomplished by Bargigly,[7] Gorré,[8] Fessenmeyer,[9] Dusche,[10] Busquet,[11] Molnar,[12] and Paulus.[13] Putégnat has published four cases in which chloroform was unavailing. Three of them were of the traumatic, and one of the idiopathic form, but the vapor was not resorted to until very late in the attack.[14] A case under the care of Grisolle was cured by opium, after chloroform had induced alarming insensibility;[15] and two instances of a fatal issue are recorded by Dr. Snow, in spite of the administration of chloroform. But the one was a case of severe burn, and the other of sloughing of the integuments.[16] This analysis, therefore, fully sustains the opinion above expressed of the value of chloroform in tetanus.

The analogy of *strychnia* poisoning and tetanus and the usefulness of chloroform in the latter disease naturally led to its trial in the other affection.[17] Dr. Anstie, it is true, from experiments upon animals, concluded that "chloroform has no direct antidotal action to strychnia;" but Mr. Sansom shows that it keeps off suffering, induces calm, and sustains the patient during the elimination of

[1] R. B. Todd, Lond. Med. Gaz., 1850, p. 1003.
[2] Lancet, June, 1848; Trans. Am. Med. Assoc., 1849, '50, '51; Am. Journ. of Med. Sci., Jan. 1853.
[3] Bull. de Thérap., xxxv. 289.
[4] Ibid., xli. 120.
[5] Ibid., xxxvi. 173.
[6] Lancet, Dec. 1853, p. 546.
[7] Bull. de Thérap., xliv. 43.
[8] Ibid., p. 172.
[9] Ibid., xlix. 236.
[10] Times and Gaz., Jan. 1855, p. 15.
[11] Bull. de Thérap., li. 90.
[12] Boston Med. and Surg. Journal, May, 1858, p. 318.
[13] Abeille Méd., xv. 193.
[14] Bull. de Thérap., xliv. 188.
[15] Ibid., liii. 46.
[16] Op. cit., p. 335.
[17] Am. Journ. of Med. Sci., April, 1850, p. 546; Times and Gaz., April, 1854, p. 316.

the poison. He also cites a case in which one grain of strychnia had been swallowed; the tetanic convulsions were fearful, but were completely subdued by chloroform, of which six ounces were used in less than six hours. The patient recovered.[1] Earlier than this, several cases of strychnia poisoning were cured by chloroform taken through the stomach on the lungs;[2] and subsequently Dr. Gobrecht reported the case of a man who attempted to commit suicide with a solution of strychnia in chloroform. The anæsthetic seems to have neutralized the spinant poison, for the patient was narcotized and not in the least convulsed. Dr. J. L. Atlee has also reported a case of attempted suicide by strychnia, in which the spasms were arrested and the patient's life saved by inhalations of chloroform.[3]

In *chorea*, the inhalation of chloroform serves as an auxiliary, at least, to other treatment. Its advantages, indeed, are marked, for in numerous cases in which other remedies were conjoined, the improvement began or became more rapid from the time when chloroform was administered. It should be employed daily, and the patient kept under its influence for half an hour or more at a time. Evidences of its value have been published in England by Marsh; in France by Fuster, Géry,[4] Bouvier,[5] and Bouchard;[6] and in Germany by C. Ritter. In a most aggravated case of chorea major in an adult, and caused by an injury of the head, when nearly every remedy had failed to alleviate the constant and terrible spasms, chloroform availed to give the patient temporary rest, but owing to the threatening signs of dissolution it was discontinued.[7]

As might have been surmised, the trials made of chloroform inhalation in *insanity* do not lead to the conviction that they exert a curative power over the idiopathic form of this disease. As a palliative of excitement, chloroform may, nevertheless, be advantageously employed in maniacal cases, and in the active forms of melancholia with a suicidal tendency. In some cases of hypochondriasis connected with gastric derangement its administration by the stomach is stated by Dr. Osborne to have done good.[8] In *puerperal mania* it has been productive of more decided and permanent benefits, and occasionally of cure.

Delirium Tremens.—The more active forms of this malady, those in which excitement and violence predominate, are said to offer the clearest indications for the use of chloroform. But it is also asserted to be useful in subduing delirious excitement, proceeding either from the primary or the secondary operation of alcohol. On examining the reports which have been published of cases in which this remedy was used, it becomes evident that large doses of opium or morphia were also administered;[9] and although in some in-

[1] Chloroform, etc., 1866.
[2] U. S. Dispensatory, 13th ed., p. 1411.
[3] Trans. Med. Soc. Penn'a, 1870, p. 70.
[4] Bull. de Thérap., xlviii. 193.
[5] Ibid., p. 321.
[6] Ibid., xlix. 29.
[7] Prager Vierteljahrschrift, cviii. Anal. p. 94.
[8] Dublin Quart. Journ., Nov. 1853, p. 463.
[9] Am. Journ. of Med. Sci., Oct. 1856, p. 368; Ibid., April, 1857, p. 317; Lancet, Oct. 1858, p. 449.

stances, when these remedies proved inoperative, chloroform inhalations appear to have produced a sleep which issued in recovery, yet it is no less evident that it also occasioned such a degree of narcotism or of syncope as appeared frequently to threaten, if it sometimes did not actually destroy, life. The action of the vapor of chloroform, when freely given, resembles too closely that of opium in excess to render it eligible in the treatment of a disease which is now well proven to be more certainly and safely cured by alcoholic stimulants.

Chloroform is probably more serviceable in this affection when it is administered by the stomach. It was originally employed by Dr. S. H. Pratt, of Baltimore, who gave it in drachm doses; first in a case marked by exhaustion, debility, subsultus, and incoherence; and, subsequently, associated with Hoffmann's anodyne and tincture of valerian, in one of maniacal violence. In both it procured sleep, which ushered in convalescence.[1] Afterwards it was successfully used by Dr. Butcher,[2] and Drs. Neligan and Corrigan, of Dublin,[3] in every instance quieting excitement and disposing to sleep. Several instances also are recorded in which its administration by the stomach produced the happiest effects, but in these the active or sthenic stage of the disease had passed by, and a general stimulant was called for by the presence of asthenic and ataxic phenomena.

If an opinion may be based on the result of a single case of *angina pectoris*, chloroform seems destined to furnish a far more valuable palliative for this distressing malady than any which has hitherto been tried. The case alluded to is recorded at length by M. Carrière,[4] and presented an aggravated example of the disease. All of the most useful remedies were employed fruitlessly. The inhalation of ether and subsequently of chloroform at once mitigated the paroxysms, then caused their cessation, and was the means of restoring the patient, who was rapidly sinking. The form of angina here referred to must have been purely spasmodic.

Neuralgia, which may always be palliated by this remedy, is sometimes permanently cured by its use.[5] The latter result is, however, a very unusual one. There is no pain so intense as that of neuralgia in its highest degree, and hence it requires for its relief the full anæsthetic power of chloroform. A case of death from this treatment is recorded by Dr. Snow. Externally, chloroform is a valuable palliative of neuralgic and *rheumatic* pains, especially in the muscular form of the latter disease.

One of the most valuable applications of anæsthesia is to *diseases of the eye*. Sulphuric ether, it has been seen, was originally applied in this manner, and now the inhalation of chloroform is constantly used to relieve the spasmodic action of the muscles of the eye, and especially of the orbicularis, which prevents a due inspection of the

[1] Am. Journ. of Med. Sci., Jan. 1852, p. 142.
[2] Dublin Quart. Journ., Aug. 1852, p. 227.
[3] Dublin Hosp. Gaz., Nov. 1854.
[4] Bull. de Thérap., xliii. 145.
[5] BARRIER, Bull. de Thérap., xxxv. 540.

organ, and the proper application to it of remedial agents. Repeated use of anæsthesia has also been found permanently to modify the sensibility of the eye in strumous ophthalmia and other affections attended with *photophobia*.[1]

Chloroform is nowhere more valuable than when administered for the relief of *puerperal convulsions*. The earliest mention of its successful use that we are acquainted with, was by Mr. Fearn,[2] Dr. Gros,[3] and Dr. R. B. Todd, who, however, states that he refers to cases occurring in the practice of others.[4] In this country, illustrations of its efficacy have been published by Drs. Van Buren,[5] Knight, Cotting, Casey,[6] and others. In his excellent essay on "Uræmic Convulsions," Dr. Braun writes as follows: "The chief object to be attained is to diminish as much as possible the reflex excitability, to weaken the paroxysms, in order to diminish the dangers, and to gain time for entering upon a rational treatment. In this respect, we have observed results from chloroform narcotism which have surpassed all expectations. In uræmic eclampsia, the chloroform narcotism is to be induced instantly when indications of an impending paroxysm show themselves—as great restlessness, increasing rigidity of the muscles of the arms, expiry of the interval between former paroxysms, fixity of expression, or tossing hither and thither. The narcotism is to be kept up until the premonitory symptoms of the paroxysm disappear, and quiet sleep follows; a result generally attained in one minute. But if it be not possible to cut short the paroxysm, then the chloroform inhalation is not to be kept up during the convulsive attacks and the comatose condition, in order to let an abundant supply of fresh atmospheric air reach the lungs. The chloroform inhalation moderates the imminently dangerous cramps of the muscles of the neck, epiglottis, and tongue, and may be continued even during a persistent trismus, when no medicines can be introduced into the stomach, and when loud mucous râles indicate the development of œdema of the lungs. In sixteen cases of eclampsia occurring in succession, which I treated with chloroform and acids [benzoic, citric, or tartaric], complete recovery always took place."[7] In the opinion of Dr. Channing, of Boston, since chloroform came into use eclampsia is as manageable a disease as any in the puerperal state, provided it be treated by inhalations of that agent alone, or combined with ether. Dr. Storer, also, expresses a high estimate of its efficacy,[8] Macario found the attacks arrested by it in two cases,[9] and accounts of its success in Australia have been pub-

[1] Mackenzie, Med.-Chir. Trans., xl. 175; Thorp, Dublin Quart. Journ., Aug. 1857, p. 106.
[2] Lond. Med. Gaz., Feb. 1848, p. 235.
[3] Bull. de Thérap., Jan. 1849, p. 27.
[4] Lond. Med. Gaz., May, 1849, p. 845. Several other cases, occurring in 1849 and 1850, are mentioned in the Lond. Journ. of Med., ii. 988.
[5] Am. Journ. of Med. Sci., July, 1853, p. 283.
[6] Boston Med. and Surg. Journ., April and June, 1850, pp. 33, 61, 177.
[7] Edinburgh Med. Journ., ii. 1123.
[8] Boston Med. and Surg. Journ., March, 1857, p. 122.
[9] Annuaire de Thérap., 1855, p. 49.

lished by Dr. Tracy.[1] In fact, in almost every part of the civilized world a nearly unanimous verdict has been pronounced in its favor.

This remedy has proved itself scarcely less efficient in the treatment of *infantile convulsions*, which, it is well known, are generally excited by the irritation of undigested food, of the growing teeth, etc. The first, and one of the most interesting of the published cases of this nature, occurred in the practice of Dr. Simpson. The patient was but ten days old when the convulsions began, and they continued to increase in severity in spite of various opiate and antispasmodic medicines, and external stimulants, until eighteen days had elapsed, when the strength failing, and laryngismus and dyspnœa occurring towards the end of each fit, chloroform was administered by inhalation. Immediately there was a suspension of the fits, which, however, returned when the anæsthetic was withdrawn. This was reapplied and administered so as to keep the patient asleep for thirty-six hours, with the exception of short intervals necessary for its nursing. No other convulsions occurred, and complete recovery took place.[2] A case almost identical with this is reported by Mr. Williams, of Manchester. The patient was ten days old, and was sixty hours under the influence of chloroform, during which time sixteen ounces of the liquid were consumed.[3] In convulsions from *dentition* the remedy has proved equally efficient, and that not only by inhalation as shown by the cases of Collins,[4] Marotte,[5] who used it by the stomach as well as in vapor, and Bowe,[6] who gave it in the former manner only, in the case of a child seventeen months old, who had been subject to convulsive attacks from the age of five months. Dr. G. H. Fox reports a case of convulsions in a child of five years completely and promptly arrested by inhalations of chloroform.[7] Like ether, it has sometimes been used with advantage to detect *simulated diseases* and in cases of *hysterical rigidity* and *contractions of the joints*. In obstinate *hiccup* a few drops of chloroform taken into the stomach will sometimes arrest the spasm. The agonizing pains of *colica pictonum* are generally relieved very promptly by this agent in the form either of liquid or vapor;[8] the same may be said of *biliary and nephritic colic*, *dysmenorrhœa*, *spasmodic stricture*, and indeed of all painful disorders whatever, but particularly of those in which pain constitutes the most urgent symptom. It is unnecessary to enter into any details regarding the greater number of these, since the instances under the head of ETHER might all be repeated here. In the case, however, of *biliary calculi*, it should be mentioned that chloroform has not only been employed with great advantage to subdue

[1] BRAITHWAITE'S Retrospect (Am. ed.), xxxviii. 227.
[2] Edinb. Month. Journ., Jan. 1852, p. 40.
[3] Lancet, June, 1853, p. 535.
[4] Times and Gaz., April, 1853, p. 380.
[5] Bull. de Thérap., xlviii. 337.
[6] Times and Gaz., Sept. 1853, p. 323.
[7] Boston Med. and Surg. Journ., Feb. 1858, p. 456.
[8] ARAN, Bull. de Thérap., xlii. 296; liv. 74.

the pain produced by the passage of gall-stones, but also as a solvent of these bodies in the gall-bladder. Dr. Thomas H. Buckler affirms that he has demonstrated its efficacy, first by proving that no other liquid dissolves them when immersed in it, and also clinically, by removing the evidences of their presence in the gall-bladder by means of chloroform introduced into the stomach. In a case which he has published,[1] and in which an indurated tumor in the situation of the gall-bladder existed, he administered a teaspoonful of chloroform every hour while the attack of biliary colic lasted, and a teaspoonful after every meal for five days longer, when the tumor was found to have disappeared. From this fact Dr. B. inferred that the calculi had undergone solution and been discharged. It cannot, however, be denied that the subsidence of the biliary tumor, so that it could no longer be felt, may have been due to the discharge of the liquid portion of the bile distending the bladder, and not to the solution and escape of the calculi which it contained. Dr. Lutton[2] some time before the suggestion of Dr. Buckler, stated that chloroform had been vaunted by some persons as a solvent of biliary calculi; but he concludes that its efficacy is very doubtful, and that, probably, it only calms the pain which they occasion. He also shows that whenever the discharge of gall-stones has been effected by means of ether, they have been expelled without being dissolved. Cases confirmatory of this view have been published by Dr. Barclay, of Leicester, England (*Brit. Med. Journ.*, Jan. 15, 1870).

Topical Application.—Chloroform, when applied to the skin, exerts the double action of a counter irritant and an anodyne; hence there is hardly any painful affection unconnected with inflammation that it is not adapted to remove or mitigate by its topical action. *Neuralgia*, *muscular rheumatism*, the pain of *exostoses*, nervous *headache*, and even *articular rheumatism*, are signally benefited by its use.[3] In the last-named affection, the vesicant action of the liquid is an obstacle to its frequent application, and has led to the employment by some physicians of "chloruretted hydrochloric ether,"[4] which, without irritating the skin, destroys its sensibility in a few minutes, and affects, it is stated, even the subcutaneous parts.

Mr. Higginson reports having used chloroform with success as a local application to the *perineum* during its painful distension by the child's head in parturition, and to the sacrum with the effect of lessening the severity of the pains. He also applied this agent to the os uteri of a patient suffering from very severe *dysmenorrhœa* by means of a sponge placed in a curved glass speculum, which was introduced into the vagina. The pain almost immediately abated. Dr. Watson reports similar good effects in *swelled testicle*

[1] Am. Journ. of Med. Sci., July, 1867, p. 51.
[2] Nouveau Dict. de Méd. et de Chirurg. Pratiques.
[3] LAROQUE, Bull. de Thérap., xxxvi. 210.
[4] ARAN, Arch. Gén. de Méd., 4ème sér., xxv. 245.

and spinal neuralgia, and also in preparing parts to which the *actual* or *potential cautery*, or the *moxa*, is to be applied, or in which an incision is to be made for opening an abscess."[1]

Applied upon cotton to painful cavities in *teeth*, it almost immediately relieves the pain, and when rubbed upon the gum around a tooth, it materially lessens the suffering caused by the operation of extraction. To be most effectually employed in *neuralgia*, a few drops of chloroform should be poured upon a small disk of woollen cloth and applied over the superficial portions of the affected nerve, evaporation being prevented by covering the cloth with a piece of money. A mixture of chloroform and tincture of aconite is more efficacious than either agent alone. In this case the counter-irritant and anæsthetic properties of the liquid unite to afford relief. In mild neuralgic and non-inflammatory rheumatism, colic, tonsillitis, and spasmodic croup, pleurodynia, and lumbago,[2] a mixture of chloroform and olive oil, to which camphor or ammonia, with tincture of aconite, may be added, forms a very efficacious liniment that may be employed for its gentle revulsive and anodyne effects. It may be used by friction or applied upon flannel or cotton wadding over the affected part. To children and delicate females this method is particularly adapted.

An ingenious and useful application of chloroform is that proposed by Dr. Hardy, of Dublin, who contrived an apparatus by means of which the vapor of this liquid can be thrown from a tube and directed upon the affected part. It was originally designed for relieving pain in diseases of the neck of the *uterus*,[3] but was subsequently applied to the treatment of various local pains, in *hæmorrhoids*, *irritable bladder*, *irritable wounds*, *anthrax*, *gout*, *rheumatism*,[4] and *neuralgia*.[5] It has also been found efficient in relieving the *buzzing in the ears* which, in some cases of deafness, forms a very constant and distressing annoyance. As mentioned elsewhere, the vapor of sulphuric ether has been used for this purpose, and Marc d'Espine injected liquid ether into the middle ear.[6] In 1854, Mr. Weatherford entirely relieved a case of this nature by the use of chloroform vapor[7] applied to the auditory canal, and subsequently Dr. Bonnafont made use of a very simple but ingenious pump for throwing the vapor into the Eustachian tube.[8] It is important to be remarked that in all of these cases of the local application of chloroform vapor its beneficial effects were not limited to its primary impression. In every case after this had subsided the pain returned in a mitigated degree, and generally by repeated applications of the anæsthetic was entirely removed.

The action of chloroform upon the cuticle singularly facilitates

[1] Am. Journ. of Med. Sci., April, 1849, p. 528.
[2] Martin-Solon, Bull. de Thérap., xi. 199; Moreau, Am. Journ. of Med. Sci., Jan. 1840, p. 187.
[3] Dublin Quart. Journ., Nov. 1853, p. 306.
[4] Ranking's Abstract, Am. ed., xxi. 120.
[5] Lancet, Dec. 1855, p. 201.
[6] Archives Gén., 4ème sér., xxviii. 422.
[7] Times and Gaz., June, 1854, p. 618.
[8] Bull. de Thérap., xlviii. 184.

the *absorption of medicines by the skin* when they are applied in a solution of this liquid. The remarkable experiments of Dr. Waller upon this subject have been noticed in the Introduction.

Administration.—The importance of using only the purest chloroform is insisted upon by all writers on the use of this liquid for anæsthetic purposes. It should have a sp. gr. of 1.48. When pure, it does not, according to Mialhe, vesicate, but only reddens the skin or mucous membrane, but the addition to it of a little anhydrous alcohol renders it actively caustic. Hence the necessity of employing the purest only for inhalation. To ascertain its quality, a few drops of the suspected liquid should be allowed to fall into a test-glass half full of water, which retains its transparency if the chloroform is pure, but becomes slightly opalescent if it contains alcohol.[1]

None but the most thoroughly washed chloroform should be used for inhalation. The difference between the effects of the pure and the impure vapor is very striking, as may be judged of from the following statement of Prof. Miller:[2] "When impure, irritation seems to be produced in the air-passages; the patient coughs and is unwilling to inspire the vapor; when becoming stupid, muscular excitement is apt to be troublesome, and a tendency to talk may be very marked; after recovery there is sickness, probably vomiting, and the nausea is likely to prove of prolonged duration. Pure chloroform, on the contrary, does not irritate the air-passages, and is much less likely to cause vomiting; the patient breathes it readily, sometimes greedily, enjoying its fragrance and sweetness very much; muscular excitement does not always occur, and, when it does, proves both manageable and transient; the patient seldom speaks or attempts to do so before the stupor; this arrives speedily and is of a less apoplectic look; emergence is calm; and all disagreeable consequences are of rare occurrence."

There is much difference of opinion in regard to the proper mode of exhibiting chloroform, some writers insisting upon the necessity of a well-contrived inhaler for the purpose, while the greater number prefer the simple method of using a handkerchief, sponge, or some analogous body upon which the requisite quantity of the liquid has been poured. The former method is advocated chiefly by Dr. Snow, whose experience and skill entitle his opinion upon this subject to peculiar weight. Dr. S. indeed shows that in nearly all fatal cases of chloroform from inhalation (37 out of 50) no instrument for the purpose was employed, and this fact would be decisive of the justness of his views were it not that an incomparably greater number of persons are subjected to the influence of chloroform without the inhaler than with it. The former category might therefore very well contain a greater number of fatal cases than the latter without the excess being chargeable to the mode of inhalation. Increasing familiarity, also, with the effects of chloroform and the habit of administering it appear to have augmented

[1] Abeille Méd., v. 16. [2] Surgical Experience of Chloroform, p. 15.

the preponderance of opinion in favor of the simpler method, which seems to be equally efficient with the other, quite as safe when skilfully applied, and free from the objection that exists to the use of any apparatus whatever that can be prudently dispensed with.

At a meeting of the French Academy of Medicine, held in July, 1857, this question was discussed, and, with a single exception, all the surgeons present condemned the use of mechanical contrivances for the administration of chloroform vapor.[1]

In relation to the substance from which chloroform should be inhaled, general opinion appears to have settled down in favor of the simplest and most convenient, a napkin, sponge, or piece of carded cotton so shaped as to present a concavity capable of extending beyond the mouth and nostrils of the patient. A funnel-shaped sponge, sufficiently porous to permit the air to pass freely through it, is one of the most convenient respirators that can be used. The sponge should be occasionally washed in alcohol and then in water to free it from the impurities that are apt to accumulate in its meshes. Experience has confirmed the general impression of physicians in the habit of using chloroform in their own practice, that the simplest mode of administering it is the best. Dr. Simpson advised that a single layer of a towel or handkerchief should be laid over the patient's nose and mouth, and on this the chloroform should be poured drop by drop until complete anæsthesia is induced. To protect the lips and the adjacent skin from the irritant action of the liquid, these parts should be previously anointed.

The quantity of chloroform employed should depend upon the degree of anæsthesia sought to be induced, and the length of time it must be maintained. In severe surgical operations from one to four fluidrachms may be poured upon the inhaler at once, but for less serious occasions, and for ordinary cases of midwifery, in which it is sufficient to produce insensibility to pain without unconsciousness, a less quantity than that mentioned will suffice, after the primary inhalation. It is a great error to suppose that in natural labor, and for the performance of minor operations, it is always necessary to put the patients to sleep. As Dr. Rigby has remarked, "a patient may be kept quite sufficiently under the influence of chloroform, for any length of time, and yet be able to hear and answer questions, and thus we frequently hear a patient remark, 'I know I have a pain, and yet I do not feel it.'" Yet it is probable that such cases are not the most numerous. Towards the close of labor, when the pains are most severe, they can very seldom be neutralized without a state of unconsciousness being induced. The administration of the vapor can be commenced at any stage of labor, but except in cases of shorter duration than the average, it is not desirable to use it before the os uteri is fully dilated, and expulsive pains have commenced. In those cases, however, in which the "grinding pains" which attend the first stage of labor are very

[1] Bull. de l'Acad., xxii 1088.

severe, chloroform may be employed to palliate them. The application of the chloroform may be renewed as often as the natural state of the patient is about to return. According to Dr. Simpson, about an ounce of chloroform will in this manner be consumed in the course of an hour. The quantity administered during any one pain should never exceed a very few minims, but in the course of a protracted labor, from four to six ounces may sometimes be required; and in one case attended by Dr. Snow, seventeen fluid-ounces of chloroform were used with the inhaler, which would produce as much effect as three or four times as much inhaled from a handkerchief.

It may be useful here to recall the several degrees or stages of anæsthesia distinguished by Dr. Snow and others, through which a patient passes while under the influence of chloroform. In the *first* stage a partial loss of sensibility exists, but the consciousness remains unimpaired. In the *second* stage there is more or less wandering of the mind, with increasing insensibility. In the *third* there is unconsciousness, with perhaps some muscular contraction, and complete anæsthesia to all but the severest irritants. In the *fourth* there is entire muscular relaxation and some stertor. The severest operations are often performed during the last stage, but not with sufficient safety; for it is separated by a very narrow line from the *fifth* stage, in which the respiration becomes impeded, and death is imminent. The proper degree of narcotism for the severer operations is the *third*, or at furthest the commencement of the fourth stage here described. It must be borne in mind that these stages are not separated by defined limits, and therefore when the stage of excitement is passed, and the patient remains quiet, and particularly when the margin of the eyelid can be touched without its causing winking, or but slightly if at all, any operation can be performed without exciting pain. As the effects of the vapor, unless very much diluted, continue to increase for about twenty seconds after the inhalation of it is discontinued, it is advisable when the patient is nearly insensible now and then to intermit its application for two or three inspirations.

But a good deal of tact is necessary in many cases to cause the patient to inhale the vapor regularly and efficiently. He naturally feels some apprehension, which still further embarrasses his movements. Everything around him should be calm and free from hurry or confusion. He should lie upon his back, if possible, with the head and shoulders raised, so that the vapor may by its gravity flow towards his mouth and nose, and the sponge or inhaler should not at first be brought too closely to his face, lest it cause by its sudden impression suffocation or alarm. But as soon as the inhalation proceeds tranquilly and regularly, the holder should be more closely applied, and as much of the vapor as possible administered in the shortest time, so as to prevent or render only momentary the stage of excitement. If spasms, difficulty of breathing, or congestion of the face, occur, the process must be suspended until the respiration grows regular once more. If there is excitement, with

startings or exclamations, and *provided that the pulse and the respiration remain natural*, the quantity administered may be increased, after which signs of relaxation generally manifest themselves, and the operation may be commenced. The condition of the pulse, and especially of the breathing, is to be most carefully watched, for if they become feeble and irregular, danger is imminent; while, on the contrary, if they maintain a normal rhythm, the safety of the patient is assured. The most reliable test of the presence of the degree of anæsthesia suited to the performance of painful operations, is the excitability of the eyelids. As long as they contract on being touched, the proper degree of insensibility has not been attained. The sign loses something of its value in hysterical persons in whom there is sometimes no winking on touching the eyelids, even when unconsciousness is scarcely induced.

A condition important to be noted is one approaching asphyxia, and produced by the chloroform having been inhaled more rapidly than it could be absorbed. The face grows livid, and the breathing is wholly suspended, or is abdominal only. The pulse is generally unaffected, and if care be taken to suspend the administration of the vapor, respiration resumes its natural rhythm.

Minor operations in surgery, and most of those called for in obstetrical practice, require no higher degree of anæsthesia than the second. Ordinary labor may generally be rendered almost painless even by the first degree described. Dr. Simpson, however, recommends that at first a large dose of chloroform should be administered so as to bring the female at once completely under its influence, and to prevent excitement. If the uterine contractions are temporarily suspended by this method, they soon return again. After the first full dose, a few inhalations before or with each returning uterine contraction are generally sufficient. The state of anæsthesia should be made deeper as the child's head is passing the vulva.

The quantity of chloroform consumed in any one case may vary considerably, and if duly administered, may be very great without causing mischief. Stanelli states that in an operation on a very delicate female, she was kept under the influence of the vapor for nearly an hour and a half, during which time about two ounces of chloroform were consumed, and yet the patient experienced no bad symptoms either during the operation or afterwards. The same author refers also to cases in which patients were kept insensible for more than two hours without any bad consequences, and quotes one from Christison, of a female who during labor consumed no less than eight ounces of chloroform, and was under its influence for thirteen hours. A still larger quantity was administered by Dr. Snow in a case referred to above.

Antidotes.—There is no antidote, properly so called, to the poisonous action of chloroform. When, therefore, the symptoms that betoken its dangerous effects present themselves, reliance must be placed almost exclusively upon measures which are in their nature adapted to restore the two declining or suspended functions,

respiration and circulation. This may sometimes be accomplished by dashing a small quantity of cold water upon the face and chest, at intervals compressing the thorax so as to imitate the respiratory act, especially in the manner recommended by Dr. Marshall Hall, and known as "prone and postural respiration," and also by endeavoring directly to inflate the lungs.[1] It has been suggested to employ oxygen for this purpose, but the suggestion is of no practical value. It is much better to force air into the lungs through the nostrils by means of a bellows, while the opposite nostril and the mouth are kept closed, and the larynx is pressed backward so as to obstruct the œsophagus. But artificial respiration is still better performed by the operator applying his own mouth over the patient's, while the precautions just pointed out are also observed. In this manner M. Ricord[2] saved several patients in whom life had become so nearly extinct that the pulse and respiration were both suspended. Dr. Snow correctly states that all the patients who are related to have been restored from a state of suspended animation, produced by an overdose of chloroform, were resuscitated by artificial respiration, and it was only by such means that he succeeded in recovering animals poisoned by the vapor of this liquid. But it is to be borne in mind that nearly all of the cases which afforded time for the successful application of this remedy, were cases of asphyxia, or of poisoning beginning at the lungs. When the primary action of chloroform manifests itself upon the heart, death is sudden or very rapid, and no time is afforded for the use of stimuli, internal and external, upon which, in the other cases of syncope, our chief dependence must be placed.

In addition to these means there have been recommended electro-galvanism, with which shocks should be transmitted through the chest, friction and warm stimulating applications to the extremities, caustic ammonia, or, what is better, boiling water applied to the skin in a tumbler covered with a towel, and inverted upon the breast of the patient. These expedients have all succeeded in preventing death when it appeared to be inevitable. Of a portion, and even of the most efficient of them, it has been very judiciously remarked by Mr. Nunneley, that some will be disposed to regard them as very paltry and meagre, and not of a very energetic or hopeful character. But it is far better to employ such as may do little good, than to have recourse to those which may do a great deal of harm, and to know how far our knowledge and power really extend, than to cloak ourselves in ignorant and meddlesome officiousness, lest our incapacity should be revealed.

CHLORAL.—Chloral.

Description.—The name Chloral, or Hydrate of Chloral, is intended to denote the origin of this substance in the action of

[1] Bull. de Thérap., xlv. 129.

[2] Ibid., xxxvii. 394.

chlorine upon alcohol. When chlorine is passed through alcohol the latter is decomposed, and muriatic acid and chloral are formed. As thus procured, chloral is an oily fluid with a very pungent smell; its vapor is very irritating to the eyes. It combines with water, forming a hydrate which consists of white rhombic crystals, and is not liable to change. The hydrate of chloral dissolves so freely in water that a saturated solution contains 50 per cent. of the hydrate, and does not readily undergo decomposition either in this solution or by heat. It is also soluble in alcohol and in ether. A watery solution of the hydrate has an acrid, pungent taste, and a fruity smell. On the addition of an alkali to its solution it is decomposed, and chloroform is set free.

History.—Chloral was discovered by Liebig, in 1832, but its hydrate was introduced into medicine in June, 1869, by Dr. Oscar Liebreich, Professor of Pharmacology in the University of Berlin. This gentleman, distinguished for original and ingenious thought, considering that in the presence of an alkali chloral splits up into formic acid and chloroform, and that the blood has an alkaline reaction, conceived that when absorbed into the circulation chloral would be in like manner decomposed, and thus, that chloroform might be generated throughout the body wherever the blood circulates. This scientific conjecture was wonderfully confirmed by experiments upon the lower animals and upon man, in which the hydrate of chloral was administered internally, and also by subcutaneous injection. Sleep was produced in each case, of much longer duration than if a corresponding quantity of chloroform had been inhaled, and no bad effects were left behind. In August, 1869, Dr. B. W. Richardson repeated the experiments of Dr. Liebreich, confirming their results, and like Dr. L. believed that on the addition of hydrate of chloral to fresh blood, chloroform is liberated, and consequently that the administration of chloral is only a peculiar method of exhibiting chloroform. The medicine was first introduced to the profession in this country by Dr. Jacobi, of New York, who presented to a Medical Society in that city an account of its discovery and action, which he illustrated by experiments upon animals.

Action. *On Animals.*—In Liebreich's original experiments, a grain and a half of hydrate of chloral administered hypodermically to a rabbit, produced a lethargic sleep lasting nine or ten hours, during which the animal was thrown over the back of a chair without its awaking. Similar results were obtained with dogs. Richardson, by the internal administration of chloral to pigeons, produced sleep with two or three grains, during which the respiration became slower, and the temperature fell. In frogs, a grain of the hydrate caused almost instant insensibility, coma, and death. Death was usually preceded by spasm or convulsions. Experiments upon fishes, mice, birds, rabbits, and other animals, give substantially the same results; and in all it has been particularly noticed that the sleep produced by chloral differs from that occasioned by other anæsthetics and narcotics in this, that it is less profound, is

easily disturbed, and as easily renewed when the animal is left to itself. In other words, it has the closest analogy with natural sleep. A striking peculiarity in the action of chloral is its power of lowering the animal temperature. Dr. Brunton found that after large doses, the temperature falls till it can no longer be measured by ordinary clinical thermometers. He also found that when equal poisonous doses of chloral were given to two similar animals, of which one remained exposed to the air, and the other was wrapped in cotton, or artificially warmed, the former perished, but the latter survived.[1] When animals are killed by large doses of the hydrate the sinuses of the brain are found, after death, distended with dark fluid blood; the membranes are injected, but the brain itself is free of congestion, and is of a natural color. The same appearances are presented by the spinal cord. The muscles are dark in color, and filled with fluid blood, which flows freely from them when they are incised. The heart contains blood on both sides, preserving the distinctive arterial and venous characters. The lungs are pale and contain blood, but are not congested. The blood coagulates with moderate firmness; its red corpuscles are somewhat shrunken and crenate (*Richardson*). From the succession of phenomena during life, and the state of the organs after death by chloral, it may be inferred that the order in which the functions are arrested by poisonous doses of the drug is as follows: 1. Those of the brain. 2. Of the voluntary muscles. 3. Of the respiratory apparatus. 4. Of the heart. Doubtless, also, these phenomena are intensified by the gradual deterioration of the blood, which may at last reach a degree inconsistent with life.

On Man.—Chloral acts upon man in the same manner essentially as it does upon the lower animals, and approaches opium in its operation more closely than it does any other of the narcotics. That is to say, it produces sleep and allays pain, although, when used within the limits of safety, it is less narcotic and less anodyne than opiate medicines. On the other hand, it seldom produces any of those disagreeable and sometimes injurious ill effects which are frequently chargeable to opium. It neither occasions nausea, dryness of mouth and thirst, nor constipation, nor loss of appetite, dysury, or dryness of the air passages, nor the headache, giddiness, or general malaise which are ordinary effects of opium. Indeed its effects, when produced by an appropriate dose, are more like natural sleep than those of other narcotics; the patient not unfrequently is readily aroused to obey a call of nature, or even to take food, and speedily falls again into a peaceful slumber. It is true there are exceptions to the general description that has been given, and occasionally the patient slumbers dreamily and awakes unrefreshed, with headache and perhaps some nausea; there may even be delirium, or a partial numbness or paralysis of the lower limbs; but these effects are very rare, and are usually traceable to an overdose of the medicine or to its bad quality. There can be no doubt that,

[1] FOTHERGILL, The Depressants of the Circulation, etc.

when properly administered, its soporific effects are incomparably more natural and free from morbid tendencies than those of any other hypnotic whatever. It has also the signal advantage of producing its effects very promptly, in from five to fifteen minutes after it is taken, and it does not require a very rapid increase of the dose to maintain them in their original completeness.

There is a difference of opinion in regard to its anæsthetic properties, some claiming that they are marked while others deny that they exist at all. One ground of this dissidence arises, doubtless, from the fact that during chloral sleep reflex excitability is not ordinarily diminished; only large doses distinctly impair it. But often the movements which occur in this manner are entirely without the patient's consciousness, and this fact seems to have been wrongly interpreted to denote the existence of hyperæsthesia which no direct evidence renders probable.

Among certain effects of chloral which cannot be called poisonous the following may be referred to. Its habitual use is very apt to produce an injected and irritable condition of the eyes, which we have observed in the case of a lady who took from ten to twenty grains of chloral every night for several months. This state did not disappear until several weeks after the medicine had been omitted. It seems to be a remote result of the paralytic condition of the circulatory apparatus which is an immediate effect even of medicinal doses of the medicine, and which manifests itself by flushing of the face, and even of the ears, neck, etc. Occasionally, also, double vision has been observed from large, though still medicinal, doses. Urticaria has been met with in a few instances, and desquamation of the cuticle with superficial ulceration at the roots of the nails has been noted. We have already alluded to maniacal excitement as an occasional effect, and one instance was related to us of several patients who were all more or less affected in this manner by chloral procured from the same druggist. It was probably impure. Dr. Cairus states[1] that a medical man, with a view of determining the proper dose of the medicine, took, the first night, one drachm, the second night two drachms, and the third night three drachms, of chloral. On each occasion the symptoms were the same in character but different in degree. After the largest dose, and in the course of ten minutes, there was great confusion of mind; a feeling of being in some distant place with anxiety to get home; consciousness of everything going on, with a propensity to utter what was felt to be nonsense; extreme restlessness; violent palpitation of the heart; panting respiration; congested face; bloodshot and staring eyes; and profuse perspiration. These symptoms continued from eleven o'clock at night, and without intermission, till six in the morning, when the exhausted patient slept for two hours and awoke with a violent headache. For three weeks thereafter there was a painful sense of drowsiness; the eyes were inflamed and sensitive to the light, and the temper very irritable.

[1] Edinb. Med. Journ., xvi. 375.

On a subsequent occasion this same person experienced very different effects; the medicine produced only a long, unbroken, and refreshing sleep. It is therefore probable that the original preparation was not pure.

Poisonous Effects.—Chloral sometimes gives rise to alarming symptoms even when its dose has been small. A lady of middle age had successfully taken, for the relief of neuralgia, chloral in doses of ten or fifteen grains. The dose was afterwards increased until it reached forty-five or fifty grains. An hour after taking it the patient felt faint, and a little later had cold extremities, an excessively rapid, irregular, and intermittent pulse, jactitation, an intolerable sense of sinking at the epigastrium, gasping breathing, and confusion of thought. The heart meanwhile acted regularly, though with diminished force. This syncopal condition was relieved by internal and external stimulants, but after an hour was renewed with increased severity; the superficial pulses were extinct, and the heart beat very feebly and with great rapidity; the mind wandered, the muscular strength was utterly prostrated; there was great dyspnœa, and great thirst, and death seemed imminent. In the course of twenty-four hours the functions were all normal.[1] Precisely similar symptoms occurred in a boy 3½ years of age, affected with whooping-cough, and who took four grains of chloral every evening for seven days. The next evening it was omitted, and the following day the symptoms of collapse occurred.[2] In the case of a pregnant female suffering from dyspnœa, about seventy grains were taken in the course of five hours. The face was intensly flushed; the eyes injected, agonizing pains affected the legs; the pulse was 120 and "bounding."[3] In a case of Dr. Tuke thirty grains nearly proved fatal with symptoms of failure of the heart; and Mr. Webb had a similar experience.[4] In a single paragraph of a medical journal[5] the death by chloral of two medical men is recorded; and in a communication of Dr. Nathan Smith, of Baltimore,[6] no less than three cases of sudden death from chloral are mentioned which fell within his own knowledge.

We have collected from medical journals twenty-one cases of chloral poisoning.[7] On analyzing them the striking fact becomes apparent that there is no uniform relation between the dose of chloral taken and its effects. Fatal effects have occurred from using seventy-five, sixty, thirty, and even ten grains of the drug; indeed the average dose in fatal cases was considerably less than

[1] REYNOLDS, Practit., iv. 188.
[2] Ibid., iv. 288.
[3] Times and Gaz,, Oct. 1870, p. 435.
[4] Lancet, Mar. 1871, p. 404.
[5] Times and Gaz., Ap. 1871; p. 367.
[6] Boston Med. and Surg. Journ., July, 1871, p. 33.
[7] Med. Record, vi. 81; Br. and For. Med.-Chir. Rev., Jan. 1872, p. 259; Am. Journ. Med. Sci., Apr. 1871, p. 591; Lancet, Apr. 1871, p. 474; Phila. Med. Times, i. 23; British Med. Journ., Dec. 1871, p. 640; Lancet, Nov. 1870, p. 742; Ibid., Feb. 1871, p. 226; Ibid., Mar. 1871, p. 403; Journ. Psychol. Med., v. 93; Practitioner, vi. 127 (2 cases); Brit. Med. Journ., Feb. 1871, p. 192; Med. Rec., v. 284; Boston Med. and Surg. Journ., Apr. 1872, p. 242; Am. Journ. Med. Sci., Oct. 1872, p. 572; Phila. Med. Times, iii. 388; New York Med. Journ., xvi. 558 (2 cases); Brit. Med. Journ., May, 1872, p. 572.

that used in cases which recovered, for in nine cases that terminated favorably the average dose was two hundred and seventy grains. In some cases disease of the heart or of the lungs may be assumed to explain the fatal effects, and in one case, perhaps, the exorbitant dose, nine hundred grains during ten days, may be regarded as a sufficient cause of death; but on the whole, chloral, like chloroform, exhibits its poisonous effects independently of its dose or of any definite condition of its victims. With these results, incomplete as they are, before him, the reader will feel that the advice given by the most eminent of English investigators of the subject of anæsthesia, requires some qualification, when he says: "One hundred and forty grains is the maximum quantity that should under any circumstances be administered to the human subject;"[1] and will rather conclude that in any dose, chloral, like chloroform, may possibly give rise to dangerous and even fatal effects, which have no fixed relation either to the size of the dose or the mode of its administration.

The essential symptoms of acute chloral poisoning denote failure of the heart's action. These are pallor and sometimes slight lividity of the face, cold extremities, and a feeble and rapid pulse, with a corresponding action of the heart. Along with these there may be tranquil sleep or stupor with stertorous breathing; the pupils are sometimes contracted, and sometimes dilated; convulsions have rarely been observed, and in one or two cases vomiting, with burning pain at the pit of the stomach and in the throat. The most sudden deaths have occurred when the dose was small, and the occasion of its administration not serious. In other cases the patients have sunk into a deep sleep from which it was often impossible to arouse them by the usual remedies for narcotism, and in these cases it was that the most inordinate doses had been taken. No lesion has been uniformly found in the fatal cases; but those of most frequent occurrence are uncoagulated blood, and the heart either distended with its contents, or quite empty.

The symptoms of *chronic* chloral poisoning, according to Richardson, are, sleeplessness, mental irritability and muscular prostration; uncertainty of movement, with a tendency to fall forward; caprice of appetite, nausea; and injection or yellowishness of the conjunctivæ. The urine may be albuminous; the bowels are constipated, and the stools pale and hard. All of these symptoms we have met with, and also a state of mental depression, irresolution, and gloom, which threatened to end in insanity.

Mode of Action.—A study of chloral narcotism renders it probable, as already stated, that it affects the functions in the following order, when its action is gradually developed: 1. the brain; 2. the voluntary muscles; 3. the respiration; 4. the heart. But it is also certain that this series of actions takes place very rapidly, so that its ultimate element is reached, and it may be fatally, before the usual antecedent links in the chain can be distinctly recognized.

[1] Brit. and For. Med.-Chir. Rev., Jan. 1872, p. 259.

When Liebreich first introduced chloral into practical medicine he proposed a very ingenious theory to account for its operation. The blood, he remarked, is an alkaline fluid; and, as hydrate of chloral, when treated with an alkali, is resolved into chloroform and a formate, so in the blood the limited amount of alkali in that fluid gradually decomposes the chloral and liberates chloroform, which then becomes the true soporific, anodyne, and anæsthetic agent. The slow decomposition, in this view, explains the correspondingly slow and imperfect effects of the medicine. This theory was accepted by Richardson, Dumas, and the greater number, and Personne claimed to have procured chloroform from the blood of dogs that had taken chloral. But these views were criticized by equally weighty authorities. Fraser held that there was no proof that chloral formed chloroform in the body; Ogle remarked that its action was the same when the blood is acid in rheumatism, as in "fever" when the blood is alkaline; and Adams, having seen thirty grains of chloral produce their characteristic effects in four minutes, asks: "What quantity of chloroform is likely to be evolved within the body from such a dose and in such a time?" It is true that MM. Horand and Peuch[1] believed that they had demonstrated the development of chloroform from chloral in the system; but the high temperature employed in their experiments vitiates all their conclusions when they are applied to the action of chloral in the animal economy. We are not acquainted with any experiments in which this question was subjected to so crucial a test as in those of Dr. Robert Amory, of Boston, Mass.[2] By a series of very ingenious and varied experiments he showed that warm freshly drawn blood does not decompose chloral hydrate by admixture with it, although, in a dialyzer, blood made strongly alkaline with caustic soda does produce such a decomposition. But there is no evidence that any such change takes place in the living body. In animals poisoned by chloral, chloroform cannot be detected in the liver or in the blood; nor does the breath of animals during the sleep produced by chloral hydrate give any indications of the presence of chloroform when subjected to the most delicate tests for this substance; yet when the animals are anæsthetized by chloroform, introduced by whatever manner into their systems, their breath instantly betrays its presence to the appropriate tests. It may, therefore, be concluded that chloral, like opium, causes sleep, because it possesses the *vis dormitiva!* In this, as in many other instances, the notion which led to the use of a medicine may be proved erroneous, although the value of the medicine and the merit of its proposer are not thereby diminished.

Experiments more or less analogous to these were performed by Hammarsten and others in Europe, where also Lewisson found that when a saline solution is substituted for blood in the vessels of a frog, the appropriate effects of the drug are manifested just as when the circulating fluid was blood.

[1] Du Chloral, Paris, 1872. [2] New York Med. Journ., xv. 606.

Uses. *Insomnia.*—The causes of sleeplessness are numerous; but the principal ones are mental excitement and pain. The former cause operates under two conditions, when the whole system is in a morbidly sthenic state and when it is in the opposite condition. It is the last-mentioned state which chloral and the allied agents are better adapted to relieve than opium, because they leave behind them slighter and more transient disturbances of other functions. When loss of sleep depends upon exhaustion of the brain produced by severe and prolonged mental application, or excitement of feeling, or when it is more purely physical, as it is sometimes observed during convalescence from acute febrile diseases attended with delirium or severe pain; and in the different forms of insanity, in which this symptom is a prominent one, and a serious obstacle to improvement, chloral has been found more useful than other soporifics.

Mania.—The remarks just made imply the utility of the drug in almost all cases of insanity attended with excitement, especially those of the acute form, such as puerperal insanity, insanity from mental shock, intense strain of mind, and similar causes. In all such cases even the temporary suspension of the mental excitement and its morbid delusions appears to allow the faculties an opportunity to recover their equilibrium and normal action.

Mania-à-potu.—This affection and its associate disorder *delirium tremens* have been very successfully treated with chloral. Dr. Balfour found that in doses varying from twenty to forty-five grains it controlled the disease in all of its degrees "from the merely excited fidgety condition known as 'the horrors', to the most exaggerated manner, often accompanied by repeated epileptiform convulsion."[1] In another group of cases under the care of Mr. Barnes[2] the action appears to have been less uniform. While in one case thirty grains were sufficient to compose and give a night's sleep to a most excited and sleepless patient, in another case seventy grains produced no effect or merely a sleep of only two hours' duration. Where its operation was effectual it acted rapidly, and in no case were any deleterious effects observed. In a case of alcoholic mania accompanied with serious surgical injury, Langenbeck, after the failure of opium, morphia, and brandy to calm the patient succeeded in doing so by a dose of sixty grains of chloral.[3] From our own observations of its use in this affection we are disposed to regard it as more efficient than any other remedy in cases of high nervous excitement, with great restlessness, and extravagant phantasms.

Pain.—Chloral has been used in a great variety of painful disorders, and with more or less benefit in all of them; but it has seemed especially to have been employed in *neuralgia.* Ehrle described the relief it afforded in cases of pain in the limbs depending upon disease of the spinal cord, as well as in those which were

[1] Edinb. Med. Journ., xv. 1014. [2] Lancet, Nov. 1869, p. 741.
[3] Times and Gaz., Oct. 1869, p. 408.

more properly neuralgic.[1] In cases of lead colic, of cancer, of tumors within the cranium or the spinal canal, it has sometimes been found a valuable substitute for the preparations of opium and belladonna. In certain cases of angina pectoris connected with valvular disease of the heart, and occurring in rheumatic, or still more, in gouty subjects, there is no doubt of the advantages occasionally derived from chloral; it sometimes mitigates the pain, and allows refreshing sleep to occur, but, on the other hand, it sometimes produces an increased sense of præcordial distress, apparently by rendering the heart feebler, and therefore less regular. In all cases with cardiac disease it should be given at first in moderate doses and very cautiously increased.

Spasmodic Affections.—In *tetanus*, according to Dr. Kidd,[2] "chloral hydrate has now saved seventeen out of twenty consecutive cases." Out of fifteen published cases which we have met with, ten recovered. In many of these the efficacy of the medicine cannot be questioned, since its administration followed that of other remedies which appeared to have no influence on the symptoms, and it immediately produced a mitigation of the symptoms. It should not, however, be forgotten that the unsuccessful cases were probably not as generally published as the successful ones. Bouchardat, in reviewing the reports which he had examined, asserts that he does not know of a single acute or grave case of tetanus cured by chloral, while the instances of its failure may be counted by the hundred.[3] This statement is certainly too absolute.

Strychnia Poisoning.—Liebreich pointed out the mutual antagonism of strychnia and chloral, and illustrated it by experiments upon animals. Dr. Macdonald has reported the case of a man who by mistake took enough of a solution of strychnia to excite violent tetanic spasms, which were entirely arrested by about fifty grains of the hydrate.[4] It is probable, as Leibreich suggested, in regard to tetanus, that chloral does not act by removing or neutralizing the poison, but simply by counteracting its effects, and that its use must, therefore, be persisted in so long as the muscular spasms continue. If it cannot be administered by the mouth, it may be given by enema, or hypodermically.

In *epilepsy* chloral has been used to mitigate and even to prevent the recurrence of periodical fits, by putting the patient asleep in advance of the expected paroxysm. It has proved strikingly useful in mitigating the movements in *shaking palsy.*[5] In a case of *tonic spasm*, in a child four months old, produced by constipation during measles and pneumonia, various remedies had been tried in vain, when chloral in doses of two grains repeated every hour, caused relaxation of the contracted muscles, and the child recovered.[6]

A number of cases demonstrate the efficacy of chloral in *puerpe-*

[1] Am. Journ. of Med. Sci., Jan. 1870, p. 235.
[2] Stone's Abstract, lviii. 101. [3] Annuaire de Thér., 1874, p. 49.
[4] Edinb. Journ., xvii. 882.
[5] Boston Med. and Surg. Journ., June, 1870, p. 456.
[6] Ibid., Mar. 1871, p. 173.

ral convulsions,[1] which was to have been expected from the analogies of its action with that of the narcotics and anæsthetics which are useful under similar circumstances.

Chorea is sometimes cured by chloral and sometimes quite unaffected by its use. In two cases reported by Dr. Hammond this contrast was observed.[2] Out of seven cases collected by Horand and Peuch, six were cured or greatly improved. Dr. Briess, of Vienna, has reported a case of exceptionally violent hysterical chorea which had for six weeks defied all modes of treatment, but the first dose of chloral of thirty grains procured some amelioration. The patient was kept almost constantly under its use for nearly a fortnight, and at the end of a month was cured.[3]

Ferrand claimed to have cured several cases of *whooping-cough* with chloral.[4] The narrative scarcely sustains this conclusion. In the out-patient department of a London hospital it is stated that of fifteen children affected with this disease, thirteen were "more or less benefited" by the chloral treatment.[5] In a similar field, Dr. Woodman found at first that in only three out of twenty-two cases was any appreciable benefit derived from the drug,[6] but subsequently he reported that the medicine seemed to form "a very valuable means of gaining time and subduing the spasm" in those cases in which the spasmodic element of the disease is predominant.[7] Dr. P. B. Porter, from observations made at the New York Dispensary for Sick Children, reached the same conclusion.[8] In various other varieties of *cough*, especially in the nocturnal cough of phthisis, it palliates this harassing symptom and promotes a tranquil sleep, without deranging the stomach or constipating the bowels.

In nervous *asthma* chloral is often sufficient to palliate, and sometimes to cut short, an attack; and in several cases of *hiccup* it has arrested this distressing symptom when various other nervine medicines, including sulphuric ether, had failed to relieve.[9]

Dr. W. W. Keen, and others, have called attention to the *antiseptic* virtues of chloral as shown by its preserving dead animal tissues from putrefaction, and correcting the fetor arising from gangrenous and other offensive sores, such as mercurial ulcers of the mouth, cancer of the uterus, caries of the bones, etc.[10]

In cases of *poisoning* by chloral it has been recommended to use hypodermic injections of strychnia, but in man this antidote does not seem to have been employed. The singular reduction of temperature of the body under its operation appears to indicate the application of artificial heat. The narcotic symptoms are to be combated with diffusible stimulants, coffee, galvanism, and me-

[1] Practit., iv. 191; Am. Journ. of Med. Sci., July, 1870, p. 272, and Apr. 1871, p. 364; Horand and Peuch, p. 79; etc.
[2] New York Med. Journ., x. 474.
[3] Boston Med. and Surg. Journ., April, 1870, p. 257.
[4] Bull. de Thér., lxxviii. 55.
[5] Practitioner, v. 151.
[6] St. Andrew's Med. Grad. Trans., iv. 222.
[7] Ibid., v. 224.
[8] New York Med. Journ., xvi. 170.
[9] Am. Journ. of Med. Sci., April, 1871, p. 363.
[10] Phila. Med. Times, iv. 385.

chanical excitants such as friction, flagellation, etc., and artificial respiration should not be neglected.

Administration and Dose.—The hypodermic use of chloral is rarely advisable on account of the local irritation it causes, and the eschars which may follow. The average dose for an adult is from ten to thirty grains. For children about one grain for each year of the patient's age. In convulsive disorders, especially of a tetanic nature, much larger quantities may be administered. The solution should not contain more than ten grains to the ounce of liquid. It may be flavored with syrup of orange peel, or syrup of tolu. Peppermint water conceals the taste of chloral very completely.

CROTON CHLORAL HYDRATE.—This substance was recently introduced by Dr. Oscar Liebreich.[1] It is a chlorated aldehyde of crotonic acid, and is formed by the action of chlorine gas on aldehyde, and occurs in small shining tabular crystals which are not readily soluble in water.

Its action, according to Dr. Liebreich, though similar, is yet unlike to that of chloral. In the dose of a drachm it produces deep sleep in twenty minutes, with anæsthesia of the head. Given to maniacs during an attack of mania, they remained quietly sitting in their chairs, their pulse and respiration being unchanged, for two whole hours together. In some cases of neuralgia, pain ceases before sleep begins. In some experiments of Dr. Yeo, a dose of twelve grains injected subcutaneously into a cat, was followed by prolonged unconsciousness, succeeded by attacks of epileptic convulsions, and death after five days. It does not appear to derange the stomach or any other organ. The indications for its use are to be found: "1. In cases where hydrate of chloral is inapplicable on account of heart disease; 2. In cases of neuralgia of the trifacial nerve; 3. In cases where very large doses of chloral are necessary to produce sleep. In such cases it may be added to the chloral."

Dr. Benson Baker has published an abstract of neuralgic cases in which the paroxysms of pain were promptly mitigated by two grain doses of croton-chloral given every hour. In such doses, at least, it occasions no bad symptoms.[2] Dr. Yeo confirms this experience by his own,[3] and points out the comparative inefficiency of the medicine in relieving other pains or in producing sleep.

The ordinary *dose* of croton-chloral is one or two grains repeated every hour, but in strong males it is recommended to be given in doses of from two to five grains every hour, or the smaller dose every half hour, until fifteen grains have been taken, if so much should be necessary. It may be given largely diluted in some well-flavored syrup.

[1] Brit. Med. Journ., Dec. 20, 1873, p. 713.
[2] Ibid., Oct. 1873, p. 484.
[3] Lancet, Jan. 31, 1874.

BICHLORIDE OF METHYLENE.

Description.—Bichloride of methylene (CH_2Cl_2) is obtained by the mutual reaction of chlorine and gaseous chloride of methyl, mixed in a glass globe, and exposed to the action of the sun's rays. It is a colorless liquid, of sp. gr. 1.344. The sp. gr. of its vapor is 2.937. Its boiling point is 88° F. Its odor resembles that of chloroform. It mixes readily with absolute ether, and combines with chloroform in all proportions. When pure it has a neutral reaction. To prevent decomposition it should be protected from the action of sunlight. Its vapor burns with a brilliant flame.

Action. *On Animals.*—Dr. Richardson found, when pigeons are subjected to the action of this preparation, that it was longer than chloroform in producing anæthesia, and accelerated the resipiration and the pulse more, but the duration of the insensibility was also longer, and the recovery more sudden. In a rabbit killed by the vapor of the bichloride, the action of the heart and of the muscles of respiration ceased at the same moment. Its lungs retained their natural color, and blood was found on both sides of the heart. Blood saturated with the bichloride is of a bright red color, and even when defibrinated, forms a clot of albumen and corpuscles. This is stated to be a peculiarity of the action of all these chlorine compounds.[1]

On Man.—The inhalation of this vapor is described by Dr. Richardson as being very pleasant, and but little irritating; drowsiness and unconsciousness coming on without any noise in the head or oppression, and recovery taking place at once and completely, without any sense of depression. An almost identical description is furnished by Dr. Strachan of the effects produce on himself by about a drachm of the anæsthetic.[2] Patients subjected to surgical operations under its influence give a similar account of their sensations. According to Miall,[3] the pulse is generally lessened in frequency, though sometimes quickened, and sometimes unaltered, and the respiration is nearly always quickened. Richardson had, in the beginning, pointed out the tendency of this agent to produce vomiting, and Miall states that it occurred forty-two times out of ninety-seven; but Mr. Gaine, whose experience was longer, had not seen a single case of vomiting,[4] and Mr. T. Spencer Wells, after a large experience of its use, declares that while chloroform, as a rule, occasions nausea and vomiting, "chloromethyl" only does so exceptionally.[5] According to Mr. Searle, it would seem to resemble ether in this, that if the patient is allowed to escape from its first influence, a stage of excitement and struggling ensues, which it is frequently difficult to subdue.[6]

[1] Braithwaite's Retros. (Am. ed.), lvi. 274; lvii. 276.
[2] Med. Record, iii. 22.
[3] Brit. Med. Journ., Jan. 1, 1870.
[4] Times and Gaz., Feb. 1871, p. 232.
[5] Lancet, April, 1871, p. 592.
[6] Ibid., May, 1871, p. 734.

Like all anæsthetics, says Dr. Richardson, the bichloride of methylene has the power to destroy life, but in a less degree than chloroform, in the ratio of nine to fourteen. In 1869, two cases of imminent death in very young children were reported;[1] another and fatal one in which a severe operation was attempted on a very feeble patient under its influence,[2] and still another with like result during the operation of iridectomy.[3]

Uses. *In Surgery.*—Mr. Spencer Wells, who was the first to employ this anæsthetic in surgery, has also furnished the largest results of its use, especially in ovariotomy, an operation which peculiarly requires an anæsthetic which is not liable to occasion accidents. The first operation of this kind performed under its use, and which was quite painless, lasted thirty-five minutes. Subsequently this eminent surgeon employed it in one hundred and eighty cases of ovariotomy, in twenty-five other cases of gastrotomy, and in more than fifty other operations of more or less severity, in which the average duration of insensibility was about fifteen minutes; yet in all of these cases there was no danger to the patient, during or after the operation, which was "fairly referable" to the anæsthetic.[4] Allusion has already been made to the experience of another English Surgeon, Mr. Miall, who employed it especially for operations on the eye, in one hundred cases. He was satisfied of its safety, and that with proper precautions it is easily managed. Mr. Gaine states that he administered the vapor with the most marked success in the following operations: Lithotomy, reduction of dislocations, fistula in ano, recto-vesical fistula, resection of the knee-joint, amputation of the leg, excision of the mamma, necrosis, cataract, etc. Records have been published of its use in operations on the teeth and for the reduction of dislocations, and also in labor;[5] but, from whatever cause, it does not appear to have supplanted to any appreciable extent either chloroform, ether, or nitrous oxide. Perhaps the reason may be found in the opinion expressed by Dr. Richardson himself, who stated that "he must be candid, and say that he was not favorably impressed with the application of the bichloride to *quick* general anæsthesia . . . It belongs to a dangerous family of chemical substances, and cannot therefore be played with without risk."[6]

Administration.—In administering the vapor of bichloride of methylene it is desirable to prevent the inspiration of any atmospheric air except what is charged with the vapor of the liquid. For this purpose it is advised to employ a hollow cone of pasteboard or similar material, fitting closely to the face and pierced with holes which permit the air to enter and dilute the vapor within the cone, which should also contain some folds of flannel or a piece of very

[1] British Med. Journ., and Boston Med. and S. Journ., Oct. 1869, p. 235.
[2] Times and Gaz., Oct. 1869, p. 524.
[3] Dublin Quart. Journ., Aug. 1870, p. 177. [4] Lancet, April, 1871, p. 591.
[5] Archives Gén., 6ème sér., xi. 362; New York Med. Record, iii. 22; Ibid., p. 418.
[6] Times and Gaz., April, 1870, p. 401.

porous sponge upon which the liquid is poured. The quantity used should not exceed, for a first inhalation, thirty or forty minims; half that quantity may be given when signs of returning consciousness appear.

METHYLENE ETHER.—In March, 1870, Dr. Richardson communicated to the Medical Society of London the results of his investigation of the properties of this substance, which he had discovered in 1867. It was produced by digesting one part of pure methylic alcohol with two of strong sulphuric acid, and then washing the gas evolved in a strong potassa solution. It remains a gas even below zero, and burns in the air. For practical purposes Dr. R. impregnated with the gas pure ethylic ether. Subsequently, the same gentleman proposed and employed a mixture of pure methylene bichloride and absolute ethylic ether, having a fluid sp. gr. of 1.100.[1] It was supposed to possess peculiar virtues as an anæsthetic which rendered it both efficient and safe. But in June, 1873, a woman of excellent general health, but afflicted with a multilocular ovarian tumor, having suddenly died during its administration, and before the operation for the removal of the tumor had been commenced,[2] the agent appears to have lost the temporary credit which it had enjoyed.

NITROUS OXIDE.

History.—When this gas was first studied by Sir Humphry Davy, the following remarkable anticipation of its uses was uttered by that great philosopher and chemist: "As nitrous oxide in its extensive operation seems capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place." This prediction was literally fulfilled when, in 1844, Dr. Wells, of Hartford, Connecticut, conceived the idea of using this agent for the purpose of obtunding sensibility, and, besides having a tooth extracted himself, also extracted others for different individuals; but being unaware of the proper mode of administering it, and being deficient as an experimentalist, he failed to secure uniform results, and became discouraged with it.[3] It was introduced into France, in 1867, by Mr. Colton and Dr. Evans, American dentists, the latter of whom had long resided in Paris. Dr. Evans induced the London Odontological Society, by paying the expenses of a preliminary investi gation, to make use of the new anæsthetic. By this means its efficiency and safety were established, and prejudice against it as an intrusive novelty was overcome.

Action.—The primary effect of nitrous oxide gas when inhaled is to stimulate the whole system; a tingling sensation is felt all over the body, and the senses seem to be unusually acute, while

[1] Times and Gaz., Feb. 1872, p. 534. [2] Times and Gaz., July, 1873, p. 3.
[3] Barker on Nitrous Oxide.

the pulse becomes stronger and more frequent; the breathing also is more rapid and shallow, and the face grows pale; in about half a minute the respiration begins to be stertorous, and at the same time the pallor of the face is replaced by a bluish tint, "a purple, ghastly, and frightfully death-like aspect," which to the inexperienced observer is apt to appear alarming. At this point, which is usually reached within a minute and a half, the state of anæsthesia is complete. Unlike ether and chloroform, nitrous oxide gas produces muscular twitching and even rigidity, so great indeed, that in operations on the mouth it is necessary before the inhalation has commenced to introduce a wedge to prevent a closure of the jaws. In general, feeble persons are more rapidly affected than the strong; children, females, and the aged more quickly than adult males. The color of the skin, the twitching of the muscles, and with them the anæsthesia, rapidly subside on the withdrawal of the gas.

The enormous consumption of nitrous oxide gas for producing anæsthesia in surgery, and especially in the extraction of teeth, has for years been increasing, and the accidents resulting from it have been altogether inconsiderable. A case is reported of coma of several days' duration, but which ended in recovery; another in which hemiplegia followed; a third in which a cataleptic condition was temporarily induced; and a fourth in which hysterical convulsions occurred. One or two fatal cases are referred to in the journals,[1] but not with such details as to determine their real causes. A case of fatal tetanus coming on ten days after the removal of a number of teeth with the aid of this gas, is surely not chargeable to its account. And it may be stated that a woman who was near fainting from fear of having a tooth extracted, revived under the inhalation of the gas, and sustained no injury from the operation. Of minor accidents than those referred to, the catalogue is also very small. Some cases of erotic delirium have been noticed during its operation, just prior to and following complete anæsthesia.[2] An advantage of this anæsthetic is that it is much less liable than chloroform or ether to occasion headache or vomiting. Its rapid and easy operation, and the fact that no disease of the heart or lungs appears to render its use improper, are points of great importance in estimating its practical value in surgery. The short duration of the anæsthesia it is usually employed to create is no objection to its use in more protracted operations, since its action has frequently been sustained for twenty minutes.

Preparation.—Nitrous oxide, or protoxide of introgen (NO), is, in its ordinary form, a colorless gas of the sp. gr. 1.527. It has scarcely any odor, and its taste is somewhat sweetish. Owing to the large proportion of oxygen that it contains, it is a supporter of combustion. It is obtained from nitrate of ammonia by heating it in a retort at a temperature of 400° F. It should be purified by passing successively through water acidulated with sulphuric acid,

[1] Dental Times, Oct. 1870, p. 84; Bienn. Retros., 1871-72, p. 445.
[2] Brit. Med. Journ., Jan. 23, 1869; Am. Journ. Med. Sci., July, 1870, p. 70.

a solution of potassa, and pure water, and then received into a large gasometer filled at first with water, by which it is still further purified. From this capacious reservoir, it can be directly drawn for inhalation; or it can be received into an India-rubber bag, of the capacity of eight gallons at least, to be carried where it may be required for use. The inconvenience of so bulky an apparatus has led to storing the gas, condensed into a liquid by cold and pressure, in iron flasks, or simply reduced in bulk by such means without being liquefied. In the latter way fifteen gallons of the gas may be compressed into the space of five pints. This method of preserving the gas prevents the loss which occurs when it is kept in a gasometer over water, which, even when cold, and without pressure, will absorb three-fourths of its bulk of the gas.

Action.—The *mode of action* of nitrous oxide in producing anæsthesia, like that of most other remedies, is the subject of very different and irreconcilable opinions, some of which have been formed without a competent knowledge of the facts of the case or of the scientific elements it involves. Even now the rationale of its operation is not clear. One writer speaks of the gas being "a powerful supporter of combustion," and also "a great combustible agent," not being aware, probably, that the two qualities are incompatible; and further, of the blueness of the integument being due to an excessive proportion of carbonic acid in the blood, the product of such combustion, whereas it is well known that the gas can undergo but little change in the system, and certainly not enough to account for the cyanosis at all. Moreover, if rapid combustion of the tissues could render the blood dark, it ought to become so during the inhalation of oxygen, which is the very opposite of the fact.

The phenomena for which an explanation is wanted are these: unconsciousness, anæsthesia, and lividity of the skin. No one of them is necessarily contingent upon either of the others, although the first is probably never present without the second, nor the third without both of the preceding ones. But anæsthesia is often marked without any venous coloration of the skin, and still oftener without any loss of consciousness. When nitrous oxide was formerly administered as "laughing gas," one of the most familiar phenomena was a high degree of mental excitement, generally exhibited in rhapsodical declamation or in singing, but sometimes also in a sudden fit of pugnacity, in which occasionally both actor and spectators were injured. We recall one instance, among others, in which a young man, sparring violently at an imaginary antagonist, struck his fist against a window shutter and fractured a metacarpal bone; yet he continued his foray, and felt no pain nor knew that he was injured until the effects of the gas had passed off, which, as usually happened, they did almost suddenly.

We shall now present summarily the views taken of the action of the gas by those who have examined the subject most thoroughly, when it will be seen that the deliriant and the anæsthetic actions just pointed out as being no less characteristic of this gas than they are of ether itself, have been almost entirely overlooked, and

that the explanations drawn only from its ultimate action are contradictory of one another.

Dr. Richardson's views are these:[1] The nitrous oxide in the lungs and the carbonic acid in the blood having about the same density, would not diffuse readily into one another, and, consequently, the carbonic acid, not escaping from the lungs, would accumulate in the blood, and a state of asphyxia would be rapidly produced, just as when carbonic acid is breathed. "These facts," it is said, explain, among other things, "the almost complete arrest of the heart's action."

According to Dr. Charles Kidd,[2] the action "is a modified form of asphyxia, with its insensibility to pain, yet freedom from danger," a condition which he compares to "hybernation." He further conceives that "the gas is not absorbed" by the blood in the lungs, but merely hinders the full access of atmospheric air to the blood; a statement which he supports by another, viz., that the same gas may be breathed over several times without losing "any of its sensible properties of rendering the patient insensible."

A distinguished physiological chemist, Dr. Marcet, teaches, on the other hand,[3] that nitrous oxide "will find its way into the blood much more rapidly than oxygen would," that to the oxygen it contains are due "the well-known early exhilarating effects," and that the later "anæsthesia is produced by the excessive formation of carbonic acid in the blood, owing to the large supply of oxygen."

To these views Mr. Coleman objects[4] by citing the fact already stated, that the gas is of such stable composition as not to be decomposed in the blood; and the question is asked, What would become of the liberated nitrogen under these circumstances? The answer is suggested by Mr. C. that its presence in the blood may suspend those molecular changes which are essential to sensation, volition, etc.

Dr. George Johnson also admits[5] the entrance of the gas into the blood, where "it replaces the oxygen," and of course suspends the functions to which oxygen is essential, and therefore occasions anæsthesia. "The lividity of the surface is a result of distension of the veins, and not of black blood in the arteries."

From a number of careful observations and experiments, Dr. Amory concludes[6] that death by this gas is "caused by asphyxia, and not by paralysis of the central organ of the circulation, nor probably by venous congestion;" and that "the anæsthesia is caused by an insufficient oxidation of the tissues by means of the blood."

Finally, and not to extend unduly this summary of opinions, MM. Jolyet and Blanche[7] deduce from a number of experiments

[1] Med. Times and Gaz., April, 1868.
[2] Dublin Quart. Journ., Nov. 1868, p. 344.
[3] Brit. Med. Journ., May 9, 1868.
[4] St. Bart.'s Reports, v. 160.
[5] Times and Gaz., April, 1869, p. 352.
[6] N. Y. Med. Journ., Aug. 1870, p. 1.
[7] Bull. de Thérap., lxxxv. 91.

this conclusion: "Nitrous oxide is not really an anæsthetic; it causes insensibility only by producing asphyxia."

If we are to accept these several statements as representing the scientific knowledge upon this subject, we arrive at the following extraordinary conclusions: Nitrous oxide acts primarily upon the heart, and affects the heart last and least of all the organs; it is absorbed into the blood, and is not absorbed at all; it is essentially asphyxiating, yet at one stage of its action essentially exhilarating; it is anæsthetic as undecomposed gas, and only its nitrogen is anæsthetic; the cyanotic hue of the skin is produced by an excess of carbon in the blood, and is due to venous stasis only; and, finally, we may observe that although nitrous oxide is regarded as an anæsthetic by all the other authorities, there are two who maintain that it is not an anæsthetic at all. It may be added that one opinion attributes the exhilaration caused by the gas to the oxygen it contains, although it is well known that oxygen when inhaled produces no such effects (*vid.* OXYGEN), and that exhilarant intoxication is a characteristic effect of the hydrocarbons.

The familiar facts stated at the opening of this discussion suffice to demonstrate that the anæsthetic virtues of nitrous oxide gas are just as certainly as those of ether, which produces similar phenomena of intoxication, quite independent of its asphyxiating power, and that it acts upon the nervous system primarily as a stimulant resembling alcohol. In its subsequent operation it still resembles that agent when taken in excessive doses so as to produce intoxication, denoted either by anæsthesia or by asphyxia, and that it in reality differs from alcohol, chloroform, and ether in its effects, not so much through its essential qualities, as by the fact of its aëriform condition when inhaled, and the facility which it thus acquires of entering the system and escaping from it, while the other agents mentioned remain for a longer time dissolved in the blood or adherent to the tissues.

Uses.—Nitrous oxide has been used as an anæsthetic in surgical operations, but chiefly in those requiring a comparatively short time for their performance. *Extraction of teeth* has been performed with its aid many thousands of times, and in all of the principal cities of this country and of Europe, are to be found dentists whose time is constantly occupied in administering it for this purpose. In Boston, it is stated that as early as 1865, in a single establishment, it had been used for this operation in nearly eight thousand cases.[1] In other painful operations of minor surgery, such as *opening abscesses*, the evulsion of *in-grown nails*, the *section of tendons*, etc., it has also been frequently made use of; but cases are not wanting in which the *reduction of dislocations*, the *rupture of anchylosed joints*, *amputations*, the *removal of tumors*, the *extraction of cataract*, etc., have been performed successfully on patients under its influence. All operations, indeed, that may be rapidly performed are suitable for the

[1] Boston Med. and Surg. Journ., Sept. 1865, p. 116.

application of this anæsthetic; but in numerous instances it has sufficed for operations lasting from fifteen to twenty minutes.

Administration.—The gas is respired from the reservoir or the India-rubber bag before referred to, through a tube terminating in a face-piece which incloses the nose and the mouth, and which is furnished with valves arranged in such a manner that, when the patient expires, the air passes out into the atmosphere, but when, on the other hand, he inspires, he receives the gas alone without any admixture of atmospheric air. In some apparatus the expired gas is conveyed into an appropriate receptacle, to be purified by washing with lime-water or a solution of caustic potassa, when it is fit for being used again.

When the gas is required for use elsewhere than where it is manufactured, it is now kept in metallic vessels in a highly compressed state, and even in a liquid form.

NITRITE OF AMYL.

Description and History.—Nitrite of amyl, $C_{10}H_{11}O,NO_3$, prepared by the action of nitric acid upon fusel oil, is an amber-colored liquid, smelling and tasting "like ripe pears." It is lighter than water, boils at 182° F., and is inflammable. It was discovered by Balard, and more fully investigated by Guthrie in 1859, who noted some of its peculiar effects upon the system, but it did not attract much attention until 1863, when Dr. Richardson more amply described its physiological properties, and suggested its appropriate uses.

Action. *On Animals.*—Dr. Richardson concluded, from his experiments just referred to, that nitrite of amyl is readily absorbed by every part of the body to which it can be applied, and in the first instance violently excites the heart and causes dilatation of the capillaries, while subsequently these conditions are followed by diminished power of the heart and contraction of the extreme vessels. He found that in cold-blooded animals it suspends animation for a longer period than any other substance; and that in certain warm-blooded animals, it can, without destroying life, reduce them to a state of "trance," or "catalepsy," which may be sustained for many hours. He concluded that it is not an anæsthetic, and that it does not destroy consciousness except on the approach of death, and that it appears to act by arresting the process of oxidation in the tissues. Finally, he regarded it as holding a place between the volatile bodies, as chloroform, on the one hand, and the solid bodies, as opium and woorara, on the other.[1] Subsequently, Dr. Brunton found that the effects on rabbits of inhaling the drug were, 1. Diminution of arterial pressure, and that whether the spinal cord in the cervical region were divided or not; 2. Increased frequency of contraction of the heart; and, therefore, 3. Diminished resistance

[1] Med. Times and Gaz., March, 1864.

of the contractile walls of the bloodvessels, and consequently diminished arterial pressure.[1] Dr. H. C. Wood, of Philadelphia,[2] has shown that in death caused by this agent the function of the heart is the last to cease, and has confirmed the observation of other experimenters that the external and the venous blood are nearly alike in appearance, and rather brown than red. He further observed that it occasions a progressive loss of muscular power, "affecting to some extent muscular contractility, to a greater extent the conducting power of the nerve-trunks, and still more profoundly the central motor ganglia." Like Richardson, he found that consciousness is retained until the whole system is profoundly affected, and that therefore the nitrite of amyl is not properly an anæsthetic. He also noted that it never acts as a local irritant; that in a remarkable degree it lowers the temperature of the body, especially when given in a lethal dose; and, as Richardson had already done, he determined that it produces a diminished excretion of carbonic acid, and consequently hinders tissue change in the system.

On Man.—In his original paper upon this substance, Dr. Richardson observed that when its vapor was inhaled through the nostrils, the action of the heart was instantly excited, the skin grew red and the face deeply flushed, assuming a bright crimson color. Carried further, the nitrite excited the breathing, and produced a breathlessness like that caused by active muscular exercise. It did not cause anæsthesia. In some experiments made by Mr. Goodheart on himself,[3] the following phenomena were observed: First, increased frequency of the pulse, the rate rising rapidly from 70 to 160 in a minute, then subsiding again as the inhalation was left off. The rhythm was somewhat irregular, and the sphygmograph denoted a corresponding failure of the impulse of the blood wave. Then, flushing of the face followed immediately upon the acceleration of the pulse; the respiration was not quickened, and when the dose was large the sight was hazy and dim. Later, a sense of lassitude and a dull headache remained. Congestion of the retinal veins has been noted by some observers, but others have not met with this phenomenon. A spectral illusion, due, probably, to some such cause, has been noted by Pick. If the patient's eye is fixed upon some definite point in a white screen, an intensely yellow circle appears, surrounded by a bluish-violet rim, on the outside of which are wavy lines. The former is explained to be the "yellow spot" of the retina, the violet rim its complementary color, and the wavy lines bloodvessels.[4]

Uses. *Angina Pectoris.*—The most successful practical applications of nitrite of amyl have been to the relief of spasmodic diseases, and especially to that just named. It appears to have been first employed for this purpose by Dr. Anstie, and by Dr. Brunton in 1870.[5] In a case reported by the former no organic disease of

[1] Med. Times and Gaz., March, 1870, p. 320.
[2] Prize Essay; Am. Journ. of Med. Sci., July, 1871, p. 39.
[3] Practitioner, vi. 12.
[4] Times and Gaz., Jan. 1874, p. 117.
[5] Trans. of the Clinical Soc., iii. 81; 191.

the heart could be detected, and the agonizing paroxysms resisted all narcotics, and even, at last, ether, arsenic, and strychnia; yet a few whiffs of this medicine put a speedy termination to the attack. In the other case extensive structural disease of the heart existed, the result of repeated attacks of rheumatic fever, yet the paroxysms were immediately mitigated in severity by inhaling the nitrite of amyl, which subsequently appeared to render them less frequent as well as less alarming. A very similar case, in which still more favorable effects were produced by the inhalation, is reported by Mr. T. Jones;[1] and Dr. Madden has published an account of his own case, in which severe angina was associated with signs of muscular and valvular disease, and was not benefited by any of the usual remedies, when he resorted to the inhalation of the nitrite of amyl, which first shortened the attacks, then mitigated their severity, and at last caused them to cease altogether.[2] The action of the medicine during the paroxysm is thus described: "The first effect was an irritating cough; then quickened circulation; then a sense of great fulness about the temples, and burning of the ears; then a violent commotion in the chest, tumultuous action of the heart and quick respiration. The angina pain then died out first in the chest, next in the left upper arm, and last of all in the wrist, where it was usually extremely severe."

Spasmodic asthma has frequently been relieved by the inhalation of nitrite of amyl. Two cases are reported by Mr. T. Jones,[3] in which the inhalation of five drops of the liquid arrested a most distressing spasm. From a case of *cardiac dyspnœa*, reported by this gentleman, it would appear that cardiac dilatation is not a necessary contraindication to the use of the agent.

In a case of *traumatic tetanus* Mr. Foster attributes the cure to nitrite of amyl, which is the only medicine referred to in his report;[4] in a subsequent case hydrate of chloral was administered in full doses at the same time with the nitrite, so that the efficiency of the latter can scarcely be estimated.[5] In *epilepsy* this medicine has been used successfully to shorten the paroxysms and render them less frequent. Dr. S. Weir Mitchell found it eminently useful in this manner in a case brought on by inordinate venery; and he suggests that in cases where a number of fits follow one another it will be found most serviceable.[6] A case of *puerperal convulsions* connected with general hydræmia, in which the nitrite arrested the attacks, and probably saved the patient's life, has been reported by Dr. W. F. Jenks,[7] who observed that the administration of the medicine was followed by relaxation of the uterus and profuse hemorrhage. This occurrence is analogous to what was observed by Mr. Jones in a case of cardiac asthma already referred to. Scarified cups had been applied to the loins, but the incisions had ceased to

[1] Practitioner, vii. 217.
[2] Ibid., ix. 331.
[3] Op. cit., p. 215.
[4] Lancet, April, 1870, p. 533.
[5] Ibid., April, 1871, p. 572.
[6] Practitioner, vii. 220; Philad. Med. Times, ii. 262.
[7] Philad. Med. Times, ii. 404.

bleed, but as soon as, under the influence of the medicine, the pulse throbbed and the face flushed, the blood again flowed freely into the cupping-glasses. Nitrite of amyl has been proposed for *strychnia poisoning*.

The action of this drug in relaxing spasm has led to its employment in spasmodic and flatulent *colic*, and that form of neuralgic *headache* which is probably associated with a diminished supply of blood in the brain. At all events it has been successfully employed in these affections, as it probably will be for the relief of spasm of the biliary and renal ducts, of the œsophagus, diaphragm, bladder, urethra, vagina, and other parts containing involuntary muscle.

Administration.—The nitrite of amyl should be administered by inhalation. Five drops upon a handkerchief or piece of folded linen is the proper dose for an adult. Sometimes it is directly inhaled from a small bottle containing a little of the liquid, by closing one nostril while the vapor is forcibly drawn through the other. As soon as fulness of the heart is felt the inhalation should be suspended. Although no bad result from its use has been recorded, it should be borne in mind that its dilating operation on the capillary vessels may possibly involve danger when those of the brain, especially, are atheromatous.

SPIRITUS ÆTHERIS NITROSI.—Spirit of Nitrous Ether; Sweet Spirit of Nitre.

Description.—The officinal spirit of nitrous ether is formed by the mutual reactions of sulphuric acid, nitric acid, and alcohol. It is a clear liquid of sp. gr. 0.837, of a pale yellow color, a fragrant ethereal smell resembling that of ripe apples, and a burning, aromatic, sweetish-acidulous taste; it is very volatile, and by evaporation on the skin produces a decided sense of coolness; it is also very inflammable, and burns with a whitish flame; it mixes readily with water and alcohol, and grows acid by keeping. In commerce it is very apt to be adulterated or changed so as to be utterly worthless as a medicine.

Action. *On Man.*—Christison relates the case of a female, in whose chamber a three-gallon jar of sweet spirit of nitre was broken. She was found quite dead, lying like one in a deep sleep. On dissection of her body, the lungs were found much congested. Kraus speaks of a boy, twelve years old, who, after taking a drachm of this liquid, was attacked with violent colic and a copious discharge of thin mucus, an effect which may probably be ascribed to the free acid contained in the medicine. According to Flourens, it causes, when inhaled, much more unpleasant and serious symptoms than ether.

Uses.—Although commonly employed for other purposes, spirit of nitrous ether is regarded by some authorities as a powerful stimulant and antispasmodic. Richter states that in relieving hysterical spasms it is often more effectual than ether itself, and

recommends it to be given in low forms of fever, as tending to sustain the strength, and, at the same time, to favor cutaneous transpiration. Nothing equals it as a diaphoretic in slight and ephemeral febrile affections; and even in those which depend upon inflammation its sedative and tranquillizing operation renders it one of the most valuable of the minor medicines. Its *diuretic* properties are perhaps more generally acknowledged; for there is no form of dropsy in which it is not employed in conjunction with other and more active medicines. Dr. Christison thinks it is least serviceable in dropsy connected with diseased kidney, and most useful in the form associated with diseased heart. This opinion is perhaps correct as regards chronic dropsies of the first class mentioned, but in that form of general dropsy which follows scarlatina, the medicine is eminently serviceable, as well as in general anasarca produced by suppression of the perspiration. In these cases it is advisable to combine with it squill, the acetate or bicarbonate of potassa, digitalis, or, as Richter advises, the infusion of calamus and juniper. It is commonly employed to relieve the strangury occasioned by cantharides, to moderate the irritant action of copaiba, to palliate gravel and all diseases of the urinary organs in which it is desirable to lessen the acrimony of the urine, or, by increasing the quantity of this secretion, to diminish the chances of calculous deposit. It may be advantageously employed in conjunction with aromatic spirit of ammonia, or with carminative infusions, for relieving flatulent distension of the stomach, or the nausea produced by indigestion.

Administration and Dose.—The dose of sweet spirit of nitre as a diaphoretic is generally stated to be from half a fluidrachm to one fluidrachm. But these quantities we regard as unnecessarily large, and as unduly stimulating. From ten to thirty drops, or twenty minims, repeated every hour or two, either alone or in some warm infusion, will generally be found sufficient. To obtain its diuretic virtues, from half a fluidrachm to one fluidrachm should be given in some appropriate vehicle. The last named quantity contains about one hundred drops.

CUPRUM AMMONIATUM.—Ammoniated Copper.

Description.—This preparation is made by rubbing together half a troyounce of sulphate of copper and three hundred and sixty grains of carbonate of ammonia until effervescence ceases, and drying the product with bibulous paper and a gentle heat. The moisture developed by this process is derived from the water of crystallization of the sulphate of copper, but the precise reaction which ensues is not accurately determined. It is, however, presumed that the sulphate of copper parts with a portion of its acid, which unites with the ammonia, and that a union also takes place between a portion of metallic copper, acting as an acid, and a portion of am-

monia. The resulting compound would then be a *cupro-sulphate of ammonia.*

Ammoniated copper is susceptible of crystallization, but, as originally obtained, is a powder of fine azure-blue color with an ammoniacal odor, and a styptic, metallic taste. It is soluble in one and a half parts of cold water; but if much diluted, it is decomposed, with the extrication of ammonia. The solution has an alkaline reaction. Acids, potassa, soda, and lime-water are incompatible with it.

History.—This salt was first procured as a solid about the middle of the last century, but Boerhaave had previously employed a solution of copper in caustic ammonia. It was introduced into the medical practice of Great Britain by Cullen.

Action.—Ammoniated copper, in medicinal doses, does not produce any immediately sensible effects upon the healthy system, but in large doses it occasions nausea, giddiness, confusion or dimness of sight, vomiting, colic, obstinate constipation or diarrhœa, and, according to Richter, if its use is persisted in, it causes painful muscular spasms or paralysis, wasting of the body, and ultimately death.[1]

Uses.—The principal application of this remedy is in spasmodic affections, for the cure of which it at one time enjoyed a high repute. The conditions most appropriate to its favorable operation are the purely functional nature and the paroxysmal character of the attack. Joseph Frank, in treating of its use in *epilepsy*, expresses the opinion that it is more useful when the disease affects adults than children.[2] Cullen found it curative in many cases, but in many also it failed. Herpin made use of it in fourteen cases, but in none with permanent benefit.[3] It is not much relied upon at the present day; but in a disease which can so seldom be treated upon any certain grounds, this remedy should not be forgotten.

Chorea, of a purely nervous form, appears sometimes to have recovered under the use of this medicine. Dr. Walker, a physician of Leeds, in the last century, affirmed that during a period of nine years he had given it to a variety of patients laboring under this affection, and that, except in a single instance, he had never known it to fail of a cure.[4] Delarive, Willan, Jahn, Niemann, and others, have also testified to its virtues; but it must not be forgotten that chorea is one of those disorders for which the greatest number of remedies have been employed, and that their ordinary success is attributable rather to the natural subsidence of the disease than to their specific operation.

In several chronic inflammations of the *bronchia* and of the *bowels*, particularly when accompanied in the former case with spasmodic cough, and in the latter with paroxysms of colic, this medicine is also reputed to have been serviceable.

Administration.—Ammoniated copper is prescribed in doses of

[1] Ausfürlich. Arzneim., iv. 466.
[2] Traduct. Fran. iii. 382.
[3] Du Pronostic, etc., de l'Epilepsie, p. 581.
[4] DUNCAN'S Med. Com., x. 288.

half a grain, gradually increased to four or five grains, or until it begins to produce nausea. It may be given in the form of pill made with bread-crumb or confection of roses, and only when the stomach contains food.

ZINCI OXIDUM.—Oxide of Zinc.

Description.—Oxide or protoxide of zinc is prepared by depriving the precipitated carbonate of zinc of carbonic acid by exposing it to a low red heat. It is a yellowish-white powder, without smell or taste, is insoluble in water, but dissolves in acids and in caustic solutions of the alkalies.

Unguentum Zinci Oxidi.—*Ointment of Oxide of Zinc.*

This ointment is prepared by mixing eighty grains of oxide of zinc with four hundred grains of ointment of benzoin.

History.—This substance was originally prepared by sublimation, on exposing metallic zinc to an intense and continued heat. It was introduted into medicine by Paracelsus, and the first physician who employed it in epilepsy was Gaubius, who learned its antispasmodic virtues from a charlatan, Ludemann by name.[1]

Action.—The imperfect experiments of Heller led him to conclude that oxide of zinc does not undergo solution in the intestinal canal, but is entirely discharged with the fæces; but Schlossberger detected it in the urine, and demonstrated its solubility in liquids such as usually exist in the stomach,[2] and Michaelis proved by experiments upon animals that it is thus soluble, and is consequently absorbed.[3] He found it in the venous blood, but not in the chyle, and observed that it is so slowly eliminated that, even when administered in large doses, it cannot be detected in the bile or urine for four or five days. It appears in the former of these secretions first. When administered to rabbits in large doses, it acts as an irritant of the stomach, producing erosion and ulceration; and, if long continued, a gradual wasting of the flesh. The author last named cites the experiments of Werneck, who administered oxide of zinc to fifteen healthy persons and to himself, in doses of four grains and upwards, occasioning eructations, nausea, confusion of the mind and senses, heat in the epigastrium, vomiting, thirst, fever, a jerking pulse, muscular spasms, etc. He also refers to the case of an epileptic patient, who, after having taken 3246 grains of oxide of zinc, fell into a state of marasmus, with œdema of the extremities, and was only rescued from death by abandoning the medicine. His epileptic attacks were in no degree improved. Similar effects had earlier been described by Richter, and Delasiauve[4] states that he had often been obliged to suspend its use on account of the obstinate diarrhœa it produced, or the invincible disgust it inspired. Yet effects of this kind cannot be of ordinary occurrence,

[1] Richter, Ausfür. Arzneim., iv. 505.
[2] Arch. f. Phys. Heil., vii. 589.
[3] Ibid., x. 109.
[4] Traité de l'Épilepsie, 1854, p. 375.

for we find that Home[1] sometimes gave as much as forty grains a day without injury; that Sieveking cured a case of epilepsy in which thirty-six grains of the medicine were taken three times a day without any unpleasant effect whatever;[2] and that Herpin, who directs forty grains a day as the maximum ordinary dose,[3] alleges it to be "a perfectly innocent remedy which may be administered in doses of ninety grains a day without any other than temporary inconvenience, and may be continued with impunity for an almost unlimited period."

Uses.—The value of oxide of zinc is not fully determined, but the greater number of cases in which it has been employed were of a *spasmodic* nature. Even in febrile affections, such as the eruptive and other continued fevers, it has been alleged to be efficient in allaying subsultus and other nervous symptoms; but such statements do not rest upon satisfactory grounds. The same remark is applicable to the different forms of *convulsion* excited by indigestion and dentition. Guersent and Blache, however, alluding to cases in which no local cause of irritation can be discovered to explain the attacks, and particularly when depletory measures have been fully tried, recommend this medicine to be given. Instead of associating it with extract of hyoscyamus, after the method of Brachet, they direct it alone, and in gradually augmented doses until as much as twenty or twenty-four grains are taken every day, divided into ten or twelve parts.[4] Their opinion of the value of the remedy is sustained by M. Trousseau, and accords with that of Percival, Odier, Voigtel, and others.

The disease for the cure of which oxide of zinc has been most celebrated is *epilepsy*. Bell, Percival, Home, La Roche, Rush, and many other physicians of half a century ago, asserted its efficacy; Odier and Hufeland attributed to it peculiar virtues; and, within the last few years, besides Néligan, who found it "more successful than any other remedy,"[5] and various writers who published isolated illustrations of its success, we have a work devoted by M. Herpin to proving its superiority.[6] Forty-one epileptic patients were treated by him with this medicine, nine of whom were under ten years of age. Of the whole number, fourteen appear to have been cured, but only eight of these without relapse.[7] It is true that, by a peculiar mode of statement, M. Herpin makes it appear that he cured twenty out of twenty-eight cases;[8] but that which we have given is less partial, and if it errs, it does so in allowing the author more than a strict judgment would warrant. Other physicians, also, who adopted his method, have not found it successful. M. Moreau, of Bicêtre Hospital, applied it scrupulously in all respects to the treatment of eleven epileptic patients, and did not effect a cure in any case. M. Délasiauve employed it on a still larger scale,

[1] Clinical Experiments, p. 220.
[2] On Epilepsy, p. 218.
[3] De l'Epilepsie, p. 568.
[4] Dict. de Méd., 2ème éd., xi. 160.
[5] Medicines, their Uses, etc.; 4th ed., p. 526.
[6] Du Pronostic et du Traitement curatif de l'Epilepsie, Paris, 1862.
[7] Ibid., p. 578.
[8] Ibid., p. 609.

and although some of the patients were temporarily benefited, others became worse under its use,[1] and, as already stated, the disorder of digestion and the disgust which it produced compelled him to desist from prescribing it. A similar result attended the numerous experiments of Dr. Radcliffe and Dr. Marcet in London,[2] and Dr. Sieveking speaks slightingly of the medicine. Oxide of zinc, therefore, can scarcely claim an exemption from the sentence of condemnation which rests upon all the specifics for epilepsy which have hitherto been proposed. It may be no worse, but it is not better, than the rest.

This medicine has been recommended in the treatment of *chorea* by a great number of physicians, including Hufeland, Borsieri, Gaubius, Duncan, Alexander,[3] Wright, Bedingfield, and Crawford. Mr. Bedingfield states that the remedy was so speedily and decidedly successful in the Bristol Infirmary, that he could not help regarding it as a specific. Upwards of forty cases occurring there were, with one exception, cured by it. Crawford also found it of the most uniform efficacy.[4] Several cases reported by Dr. Barth, of Sierentz, and regarded by him as chorea, but which were rather instances of irregular convulsions, appear to have been cured chiefly by this medicine.[5] Unlike epilepsy, chorea tends spontaneously to a cure, and unless the influence of a medicine upon it is very prompt and decided, its therapeutic value is difficult to determine. In the present case sufficient details have not been furnished to enable us to form a rational opinion upon this point.

Dr. Marcet has found great advantage from the use of oxide of zinc in *chronic alcoholism*, attended with want of sleep, trembling, vertigo, tinnitus aurium, muscæ volitantes, and occasional hallucinations. The cure was often effected by administering the medicine in doses of two grains twice a day after meals, if given in pill or powder, but in fractional doses if dissolved in carbonic acid water, which is said to be preferable. The dose should be gradually increased to two or three times the quantities mentioned. Dr. M. thinks he has detected a narcotic property in oxide of zinc.[6]

Oxide of zinc is also reported to have cured *whooping-cough*, *spasmodic asthma*, *intermittent fever*, and *chronic dysentery*, but the instances of its alleged efficacy are too few to inspire any confidence in its use in these affections.

Dr. Theophilus Thompson states that the *night-sweats of phthisis* are more certainly controlled by this medicine than by any other with which he is conversant.[7] He prescribed it in conjunction with extract of conium or of hyoscyamus. This statement has been confirmed by the reports of Drs. J. B. S. Jackson, Coale, and Abbott, of Boston,[8] the last-named of whom has published an abstract of twenty-three cases illustrating the efficacy of the treatment, and

[1] Op. cit., p. 274. [2] RANKING's Abstract (Am. ed.), xxvii. 63.
[3] CANSTATT, Med. Klinik, iii. 344.
[4] Cycl. of Pract. Med., i. 411. [5] Bull. de Thérap., xlviii. 169.
[6] Times and Gaz., 1859 and 1862.
[7] Lancet, Aug. 1854, p. 97. [8] Bost. Med. and Surg. Journ., lvi. 249, 294.

from which it appears that he usually prescribed four grains of the oxide with three of extract of conium. Dr. Jackson gave the former medicine alone, and in doses of seven or more grains, and also found it useful in cases of profuse perspiration unconnected with consumption of the lungs.

Externally oxide of zinc is employed in powder, and in an ointment (*Unguentum Zinci Oxidi*), as a protective, astringent, and mildly stimulant application. It is peculiarly adapted to ulcerated surfaces which are sensitive, present exuberant and flabby granulations, and discharge pus copiously. In powder it is much used either alone or with lycopodium, gum-Arabic, starch, or fine lint to heal *fissures of the nipples*, *anus*, and other parts habitually moist; *herpes*, limited eruptions of *eczema*, and *impetigo*, *ulcers* of the nasal passages (ozæna), and chronic *leucorrhœa*. In the last two diseases it can be mixed with water and injected. The *ointment* is useful in all cases of superficial *abrasion* and *ulceration* after active inflammation has subsided, in *ophthalmia tarsi*, and to allay irritation in the skin diseases before mentioned.

Administration.—Oxide of zinc may be given in powder or pill, and in doses of from one to five grains or more. If it excite nausea or gastric uneasiness, the dose should be diminished.

ZINCI VALERIANAS.—Valerianate of Zinc.

Description.—Valerianate of zinc may be prepared by the double decomposition of valerianate of soda and sulphate of zinc dissolved in water at 212°. At a temperature of 200°, crystals of valerianate of zinc form upon the surface of the liquid, from which they are removed, and, after having been washed in cold water, are dried. When pure, the crystals are of a snowy whiteness and a brilliant, pearly lustre, and of a tabular form. They have a somewhat bitter, slightly styptic and metallic taste, and a feeble odor of valerian. They dissolve in one hundred and sixty parts of water, and in sixty of alcohol of sp. gr. 0.833.

History.—This salt was first proposed by Prince Louis Lucien Buonaparte, employed by Muratori and Cerulli, of Bologna, and tested experimentally in 1844 by M. Devay, of Lyons.

Action and Uses.—The sensible effects of the medicine upon the healthy system are usually inappreciable, but it is claimed to possess singular powers of controlling neuralgic pain and nervous derangement. As, however, it was at first a very costly preparation, and is seldom to be procured in a pure state, the negative results of its administration in many cases do not necessarily invalidate the reports of its more favorable effects on other occasions. It must be confessed, however, that fancy rather than experience seems to have suggested the idea to M. Devay that there is something more in this medicine than a mere association of agents possessing analogous qualities; that, in fact, it represents the antispasmodic

virtues of both carried to the highest power. In that case it would stand alone, the only medicine of a new class.

There can be no reasonable doubt that valerianate of zinc has proved an efficient remedy in certain obstinate cases of pure *neuralgia*, especially in persons of a highly nervous or hysterical constitution. Dr. Delioux found it very useful in the treatment of *nervous vertigo*, an idiopathic phenomenon, or one, at least, which is associated with a slight degree of impoverishment of the blood, if with any sensible organic condition. It is characterized by an apparent gyratory motion of surrounding objects, with a sense of sinking, rocking, or rolling, or with the absolute falling of the patient, the ground appearing to give way beneath the feet, and which has been aptly compared to the sensation experienced in a ship rolling at sea. It may be conjectured to depend upon an irregular action of the vaso-motor nerves of the brain. When this condition exists without any notable alteration of the blood, or any other appreciable cause, the author we have named asserts that valerianate of zinc is its most certain remedy. He prescribes it in doses of one or two grains three times a day, associated with extract of valerian.[1] Dr. Neligan affirms valeriante of zinc to be very useful in the ordinary *convulsive affections* of children and young persons of either sex. Dr. Harley has reported the case of an hysterical girl of fourteen, who was apparently cured by this medicine of a violent and incessant *nervous cough*. It is also alleged to have cured *epilepsy* and *chorea*.

Administration.—Valerianate of zinc may be given in the dose of one grain two or three times a day, in pill made with mucilage or conserve of roses, or in some sweetened aromatic water, such as orange-flower water. In preparing the solution, the salt should first be triturated with a small quantity of water.

[1] Bull. de Thér., liii. 49.

Class VII.

SPINANTS. (TETANICA.)

It was stated in the introductory remarks to the Class of Cerebro-Spinal Stimulants that certain medicines act "exclusively upon the spinal marrow." These have been arranged in a separate Class, under the title *Tetanica*, and are also designated by the barbarous vernacular term *Spinants*. They are few in number. Indeed, strychnia is the only substance which operates as a stimulant of the whole spinal nervous system. Ergot and borax, in virtue of their special influence upon the uterine muscles, are held to be stimulants of a limited portion of the spinal marrow, and to belong, therefore, to the present class of medicines; but their special application in therapeutics renders their position more appropriate elsewhere, the one with Emmenagogues and the other with Irritants.

The spinal marrow is the organ upon which the power of muscular motion appears directly or indirectly to depend, but, apart from the brain, it does not give rise to motion in any determinate direction. The brain, as the organ of perception and of will, controls the mode of muscular action. It does so evidently in regard to all the movements which bring the individual in relation to external things, and, by education and the power of the will, it becomes capable of controlling, to some extent at least, the contraction of muscles, usually described as involuntary. There is, consequently, some reason to doubt the correctness of the ordinary division of the nerves into voluntary and involuntary. Again, causes which impair the nutrition of the whole body necessarily impair the muscular system, as well that part which is removed from the ordinary influence of the will, and which is usually called organic, as that which the will habitually controls, and which is described as the muscular system of animal life, of the life of relation, etc. A study of the examples furnished by experience of the loss of muscular power shows that this may be owing to some defect either in the nervous organs themselves, or in the muscular system. If the muscles of a limb are wasted by mechanical pressure, the limb cannot move, as in health, however perfect the power of the nervous system may be; and, on the other hand, the muscles may retain their due development, and yet be motionless,

if the nervous centres cease to generate power, and in sufficient amount. But the cessation or diminution of the generation of nervous power may depend either upon temporary and removable causes not affecting the organic constitution of the nerve centres, in which this power is generated, or upon a physical deterioration, or even a disorganization of the nerve centres or trunks. In the latter case, there is no remedy; in the former, the cure will depend upon our power of promoting the nutrition of the muscles, or of stimulating the nervous centres to increased activity. We have seen elsewhere how potent electricity is in quickening muscular nutrition and developing nervous power; and, were it not that this agent appears to act directly upon nutrition, as well as upon the nerves, it might with great propriety be classed along with the one we are about to examine more particularly.

Medicines capable of producing tonic spasm must be regarded as excitants of those nervous centres upon which the provoked movements depend. Such as appear to act as special stimulants of the gravid uterus probably limit their operation on the spinal axis to its lower portion; but strychnia plainly stimulates the entire centre of muscular motion. It is to strychnia, therefore, we may have recourse in all cases of loss of muscular power in the organs of nutrition, or those of relation and locomotion, provided that the paralysis depends upon some other cause than a lesion of the substance of a nervous centre or trunk. But as the phenomena are by no means determinate which denote this condition, the mere suspicion of its existence, however well supported, except by permanent muscular contraction and rigidity of the paralyzed part, should not induce us to abstain from a cautious exhibition of the appropriate remedy.

NUX VOMICA.

Description.—Nux vomica, and its active principle strychnia, are the products of *Strychnos Nux vomica*, a tree belonging to the natural family Apocynaceæ, which is quite common on the Coromandel Coast, the island of Ceylon, and the neighboring countries. It is of moderate size, and has a thick trunk with a grayish mottled bark, covered in parts with a reddish-brown efflorescence. The leaves are oval, shining, and leathery; the flowers greenish-white, and arranged in small, terminal corymbs. The fruit is ovoid, orange-colored, one-celled, pulpy, about the size of an apple, and containing many seeds.

The seed or bean, which is the officinal portion, is about an inch in diameter and two lines in thickness, somewhat depressed on one side and slightly convex on the other, or button shaped; of a greenish-gray color, and a silky, lustrous surface, owing to the fine close hairs which are set obliquely upon it and extend slightly beyond the edge. It is extremely hard, and is pulverized with great difficulty. Internally, "it consists of a horny, whitish, or

yellowish albumen, which separates into two parts, and contains in a small cavity in the circumference the embryo with its two acuminate cotyledons." The seeds are inodorous, but their taste is intensely bitter and acrid.

The powers of nux vomica depend upon two alkaloids, *strychnia* and *brucia*, which it contains in combination with igasuric or strychnic acid. Of the two, the first named is the most important. It usually occurs as a granular powder of a grayish-white color, inodorous, and intensely bitter to the taste. "It is soluble in 2500 parts of boiling and in 6667 parts of cold water; but this last solution, if diluted still further with 100 times its weight of water, tastes strongly bitter."[1] It is soluble in eight parts of chloroform.

The official preparations of nux vomica are these:—

EXTRACTUM NUCIS VOMICÆ.—*Extract of Nux Vomica.*

It is prepared by evaporating to a proper consistence a tincture of nux vomica made by percolation. Dose: one-half a grain to one grain.

TINCTURA NUCIS VOMICÆ.—*Tincture of Nux Vomica.*

Eight troyounces of finely-powdered nux vomica are digested with a pint of alcohol with the aid of gentle heat, and by percolation with a sufficient quantity of additional alcohol, two pints of tincture are obtained. Dose: five to fifteen drops.

STRYCHNIA.—*Strychnia.*

In the process for obtaining this alkaloid, rasped nux vomica is macerated in water, acidulated with muriatic acid, and the mixture is then boiled and strained. The muriatic acid is then separated from its combination with the strychnia and brucia by means of lime, and the brucia is removed by washing with diluted alcohol. The remaining precipitate is then purified by boiling with alcohol, which is distilled off and the residue saturated with sulphuric acid, boiled with animal charcoal, and precipitated by ammonia. Dose: one-sixteenth to one-sixth of a grain.

STRYCHNIÆ SULPHAS.—*Sulphate of Strychnia.*

This salt is prepared by neutralizing strychnia with diluted sulphuric acid. Dose: one-sixteenth to one-sixth of a grain.

Medical History.—It is generally supposed that we are indebted to the Arabians for a knowledge of this drug, but the effects ascribed by them to Dschawz elkali, translated as strychnos nux vomica,[2] are quite different from those of the last-named substance. It is stated to be emetic and purgative, and its dose is given as two drachms; but no allusion is made to its possessing poisonous properties. The only analogy between the Arabian description and that of the present day, consists in this, that one author expressly states that the medicine is useful in paralysis and locked jaw. The seeds are reckoned among the most powerful vegetable poisons by

[1] NELIGAN, Medicines and their Uses, 4th ed., p. 445.
[2] EBN BAITHAR, ed. Sontheimer, i. 270.

the Hindoos. Pomet says that its specific action is diuretic, that it is a mortal poison to quadrupeds, and is used to destroy them. He adds that it is affirmed not to be poisonous to man.[1] So Bonetus, a few years previously (1693), after describing minutely its effects upon cats, precisely as more recent experimenters have done, says that it is *alleged* to be poisonous to man.[2] Lemery declares positively that it is *not* poisonous to man.[3] Although two or three scattered examples of death from its use may be found related by Matthiolus and by Hoffmann, its real qualities were certainly unknown until in recent times the more general use of the drug, and especially of its active principles, have rendered its poisonous effects unhappily familiar to every physician. Alston gives a full account of the subject.

Action. *On Plants.*—The experiments of Marcet prove that a solution of five grains of the extract of nux vomica in an ounce of water, caused a plant (*Phaseolus vulgaris*) to die within twelve hours. Bouchardat found that water containing $\frac{1}{1200}$ part of muriate of strychnia or brucia, was sufficient to kill a plant in five days.

On Animals.—It acts poisonously upon all, but in different degrees. Desportes gave a hen nux vomica in gradually increasing doses until she took nearly two and a half drachms a day. Ruminating animals appear to be less easily affected by it than any other quadrupeds. Fishes placed in water containing the $\frac{1}{25000}$ part of muriate of strychnia, die within ten minutes. Flies die in convulsions, and intestinal worms are destroyed by this preparation.

The writers quoted by Murray say that the rapidity of the operation of nux vomica varies. If given to dogs, they pant in breathing, seem alarmed, and if forced to rise, their limbs are rigid. Tetanic spasms ensue, and, with short intermissions, recur until death. During the spasms, according to these early experimenters, the animals appear to be insensible to all impressions, so that even their ears or tails may be cut off without eliciting signs of pain.[4]

More modern observers have conducted experiments with nux vomica and its preparations under extremely various conditions, but their results have been singularly uniform, and may be described as follows: By whatever avenue introduced into the system the effects are essentially the same, but are more or less marked according to the absorbent power of the surface to which the poison is applied.[5] Hence the phenomena are developed most rapidly when it is injected into the veins. These phenomena consist of paroxysms of tetanic convulsions, from one to seven minutes in duration, and with like intervals of repose between them. After a more or less frequent repetition of these, and according to their severity, death sometimes takes place by asphyxia produced by a tonic spasm of the respiratory muscles. After death, in these cases, no other lesion

[1] Hist. des Drogues, 1706.
[2] Polyalthes, iii. 573.
[3] Hist. of Drugs, p. 138.
[4] Apparat. Medicam, i. 707.
[5] Ségalas, and also Leroy, have shown that in rabbits the poison is absorbed from the bladder as rapidly as from the stomach.

is found than congestion of all the internal organs, as in other cases of asphyxia. Some experimenters have added to this cause of death tetanic spasm, or, more probably, exhaustion of the heart, for it is found that this organ after death has lost its irritability.[1] The experiments of Mr. Harley are regarded by him as proving that death from strychnia may occur independently, 1st, of exhaustion; 2d, of asphyxia from closure of the glottis; and 3d, of suffocation from spasm affecting the respiratory muscles;[2] and that it does probably occur because strychnia destroys the power of the tissues and fluids of the body to absorb oxygen and exhale carbonic acid. This conclusion is in direct opposition to that of Dr. Brown-Séquard, who has proved that the action of strychnia consists in an increased nutrition of the spinal marrow, by which excess of nutrition the reflex faculty becomes intensified, and also in a special power of stimulating this nervous centre independently of the quantity of blood which it contains. Kölliker's experiments demonstrate that in whatever manner the agent acts, it does so upon the nervous centres alone, and not upon the nerves themselves or on the muscles. He further shows that the loss of power and excitability in muscles tetanized by strychnia is a consequence of their previous over-excitement. He concludes that, in frogs at least, strychnia exerts but little action upon the heart. His experiments also prove that during the action of strychnia spasms may be excited by a stimulus proceeding directly from without, or transmitted through the brain.[3] The last proposition is illustrated by the statement of Dr. M. Hall, that if a dog under the milder form of strychnism be allowed to remain quiet, it will recover, while, on the other hand, if continually excited, it will as certainly die.[4]

The ingenious and interesting experiments of Dr. A. I. Spence in regard to this subject,[5] confirm the conclusions which have been already stated. He showed that strychnia applied directly to the nerves of frogs, produces no effects whatever, but that its application to the medulla oblongata and spinalis immediately develops specific phenomena. He also proved that even when injected into the abdominal veins it remained ineffectual if the ventricle of the heart was cut away so as to prevent the poison from being thrown through the arteries into the nervous centres. On the other hand, his experiments demonstrated that the poison, if taken into the stomach, acts only when its access to those centres is not prevented. Its mode of action, he concludes, consists in stimulating the nerve cells to excessive action, and keeping them in that condition until they perish from exhaustion. But before this process is completed, death may take place from asphyxia brought on by spasm of the respiratory muscles. These results, and the inferences from them, enable us to explain why the earliest symptoms of tetanus from strychnia, as well as from other causes, are so commonly ex-

[1] GALTIER, Toxicologie, ii. 258; BALYDON, Lancet, July, 1856, p. 72.
[2] Lancet, June, 1856, p. 648.
[3] VIRCHOW's Archiv, x. 239.
[4] Lancet, Feb. 1853, p. 128.
[5] Edinb. Medical Journal, xii. 44.

hibited by the muscles under the immediate dependence of the medulla oblongata; its reflex cells are the most highly developed, and the most sensitive to stimulation of any in the nervous centres.

On Man.—It is said that when the powder of nux vomica is long handled, it produces a partial vesication of the fingers. Upon the bare cutis this substance, as well as strychnia, acts powerfully as a local irritant. Internally, and in small doses, both exert a decidedly tonic action, increasing the appetite and the secretion of urine, and the fæcal discharges also, when these are infrequent, but, on the other hand, diminishing them when their frequency depends upon an atonic condition of the bowel. Its continued use, like that of bitter tonics generally, deranges the digestion. It appears to augment the secretions of the mouth and stomach, as well as those of the liver and pancreas, and to augment the tone of the muscular coat of the bowels and bladder. It may be detected in the urine by chemical tests. Its action upon the bladder is shown by its disposing to frequent urination, and by its causing, when given in full doses, retention of urine, first by producing muscular spasm of the neck of the bladder, and ultimately loss of power in the muscular coat of the organ. In like manner it is reported to excite uterine contractions, to promote the menstrual discharge, to dispose to venery, and to produce erections of the penis. The action of strychnia is mainly expended upon the peripheral portion of the nervous system. In doses of one-twentieth of a grain, it seldom exhibits any effects, except on paralyzed muscles, or, if otherwise, only a slight formication of the skin, and a transient rigidity of the lower jaw and limbs. As the dose is increased, a sense of heaviness and debility is experienced, with general stiffness of the muscles and clonic spasms.

In *poisonous doses*, the symptoms produced by this medicine are very striking. They may be developed gradually or rapidly according to the quantity, the degree of division, or the solubility of the preparation, and the degree of repletion of the stomach. In the former case, the patient complains first of general uneasiness, restlessness, soreness, and heaviness in the limbs, and stiffness of the joints and muscles, particularly those of the chest and lower jaw, and these are succeeded by spasmodic symptoms. When the dose has been large, or the conditions favorable to its rapid absorption, the first phenomena are clonic spasms, or violent muscular twitches, which, with the accompanying sensation, have been compared to the effects of an electric shock. These phenomena are succeeded by thoroughly tetanic spasms of all the muscles, during which the limbs are rigidly flexed or extended, the lower jaw firmly fixed against the upper, and the body arched as in opisthotonos. The rigid contraction of the respiratory muscles renders breathing laborious, or even temporarily suspends it altogether, and, as a consequence of this immobility of the chest, a stasis of blood takes place in all superficial veins, giving a livid color to the skin. The pulse is rapid and unequal both in volume and force,

and the heart is also rapid and fluttering. The retracted corners of the mouth disclosing the set teeth, the foam issuing from between them, the staring eyes, and the contracted brow, lend to the countenance an expression of anguish mingled with affright. Amidst this horrible array of symptoms the mind remains unaffected, and it is even probable that little pain is experienced. The convulsions may continue without intermission until death, but more generally they are interrupted by intervals of calm, or rather of exhaustion. At this time, however, the slightest stimulus, a breath of air, a sudden noise, or the lightest touch, may act with the suddenness of an electric shock to renew them. As they succeed one another, the violence of the muscular contractions may diminish, but not so the disorder of the circulation and the exhaustion of the nervous force; these augment continually, the congested state of the bloodvessels grows more and more decided, and in the intervals between the fits the prostration is more complete. Finally, the patient dies either from asphyxia or from asthenia, according to whether his death occurs during the paroxysms or during their suspension.

The peculiar symptoms of strychnism once developed tend rapidly to a fatal termination, and generally within an hour or two at most. A few minutes only have in some cases elapsed between swallowing the poison and death. When, however, from the rejection of a portion of the poison, or from other causes, a fatal issue is escaped, the patient always complains of extreme fatigue and exhaustion, and sometimes of muscular stiffness and neuralgic pains, which may last for several days.[1] The fact already noticed, that an animal or person under the influence of strychnia will be less convulsed the less they are disturbed, is further illustrated by numerous cases in which lethal doses of the poison having been taken, the accession of the characteristic symptoms has been greatly delayed by perfect repose, and especially by sleep.

The smallest quantity of nux vomica which is known to have caused death is said to have been three grains of the alcoholic extract. Of strychnia, the least dose which is recorded as having proved fatal to an adult appears to be half a grain. But one-sixteenth of a grain of strychnia has destroyed the life of a child between two and three years of age in four hours.[2] Recovery occasionally takes place after very large doses, such as three or even four grains of strychnia.[3] This quantity has not unfrequently been taken without fatal results when it was reached by gradual increase from a fractional dose. Dr. S. S. Harris reports two cases of recovery after a dose of from six to eight grains,[4] and Dr. H. G. Thomas, one in which five grains were taken without a fatal result.[5] A still more remarkable case is reported[6] in which, after a full

[1] A full account of the poisonous effects of strychnia is given by Husemann in Journ. f. Pharmacodynamik, etc., i. 469.
[2] TAYLOR, Guy's Hospital Reports, 3d series, xi. 298.
[3] WHARTON and STILLÉ, Med. Jurisp., p. 516.
[4] Am. Med. Times, i. 100.
[5] Ibid., p. 243.
[6] TSCHEPKE, quoted by GRAY; *Strychnia*, 1872.

meal of flour and cranberries, eight or ten grains of nitrate of strychnia were taken, and shortly afterwards twelve grains of pure strychnia, both suspended in bitter almond water. To this were added ten grains of acetate of morphia, and the inhalation of chloroform. The symptoms of strychnism were very violent, but the patient ultimately recovered. This result was attributed partly to the tannic acid of the cranberries, rendering inert a portion of the strychnia, partly to the large mass of food in the stomach, and finally to the coincident, but antagonizing operation of the hydrocyanic acid and the morphia.

The *lesions* said to be produced in fatal poisoning by this substance are neither uniform nor characteristic. Cadaveric rigidity is usually marked; with opisthotonos, arching of the soles of the feet, clenching of the hands, and flexion of the arms across the chest. The face is usually pale, but is sometimes livid. The muscles are generally rigid, and all of the internal organs are gorged with blood, the brain and spinal marrow neither more nor less than the rest. The latter organ is stated in some cases to have been softened, and its arachnoid cavity to have contained serum. But the authors who have described such lesions clearly did not find them after the tetanic spasm of strychnism. Had they existed they would have produced paralysis, and not spasm. Strychnia has been said to produce a tendency to dissolution in the blood, *i. e.*, a diminished proportion in its solid elements. But in cases of poisoning by this agent the state of the blood is evidently the immediate effect of asphyxia.[1]

Uses. *Paralysis.*—The first suggestion of strychnia as a remedy for paralysis proceeded from Fouquier in 1811. He was led to test its virtues by observing, in some experiments upon animals, that it produced spasms, and his first trials were successful. At once he noticed that its primary influence was manifested *in the paralyzed muscles*, and might be restricted to them by a proper graduation of the dose employed. He also observed that the artificial spasm or rigidity was generally displayed in the flexor muscles of the upper, but in the extensors of the lower limbs, and he described the paroxysmal characters of the active phenomena and the more continuous constriction and oppression sometimes felt. His experience, even at the beginning, taught him that the remedy must be used with great circumspection in paralysis depending upon lesions of the brain or spinal marrow, and that its power is chiefly manifested in functional forms of the disease, or peripheral paralysis, produced by such causes as these: venereal excesses, abuse of opium, alcoholic intoxication, lead poisoning, anger,

[1] The following references to cases of poisoning by nux vomica and strychnia may be consulted: Times and Gaz., July, 1867, p. 5; Lancet, July, 1867, p. 41; Prager Vierteljahrs, xcvi. p. 19; Liverpool Reports, ii. 89; Guy's Hosp. Rep., 3d ser., xiv. 264; Med. Record, iii. 401; Annales d'Hygiène, 2ème sér., xxiv. 398; Lancet, May, 1869, p. 762; Bull. de Thérap., lxxx. 49, 145; Analysis of 143 Cases, Glasgow Med. Journ., iii. 167; British Med. Journ., June, 1872, p. 660; Boston Med. and Surg. Journ., Sept. 1879, p. 138.

fright, gout and rheumatism, concussion of the spinal marrow, hysteria, etc.[1] Many of these cases are now classed as *reflex paralysis*. In the work from which these facts are drawn the reader will find a number of examples given of the efficacy of the remedy. As early as 1823, Andral showed its power in lead palsy.[2] In 1830, Dr. Geddings, of South Carolina, reported several cases of paralysis from drunkenness cured by this medicine. One of them was a very aggravated case of general paralysis.[3] In the same year, Dr. J. L. Bardsley published an account of his success in a large number of paralytic cases, pointing out its peculiar value in those unconnected with lesions of the nervous centres, and especially in paraplegia.[4] He also showed the virtues of brucia in affections of the same nature. Pétrequin, in 1839, cured four cases of paraplegia by the use of strychnia internally, and the use of an embrocation containing tincture of nux vomica. The latter he found curative in anæsthesia.[5]

The caution enjoined by Fouquier in regard to the use of the remedy in central paralysis was still more emphatically reiterated by Lallemand in 1820,[6] and as other physicians met with cases of the sort in which it was manifestly injurious, there arose a general indisposition to employ it. Still later, however, as its special appropriateness to the treatment of other paralytic disorders became developed, the medicine gradually regained the confidence of the profession. Yet it need not be entirely excluded from the therapeutics of even central paralysis, provided that its use be restricted to cases in which the symptoms have long been stationary and there is no excitement. Although a cure may not be expected from it, still, if employed with circumspection, it is capable of carrying improvement to its farthest limit. But the utmost caution should be observed, and the progress of the medicinal influence so closely watched as to restrain its action within the bounds of safety.[7]

The cases to which it was originally applied continue to be those in which it renders the greatest service, those, namely, of impaired innervation. Whether in these the paralysis be limited to the tongue or the muscles of one eye, or whether it occupy the greater part of the voluntary muscles, this remedy affords a better prospect of relief than perhaps any other. The special conditions which render the treatment of paralysis by strychnia appropriate are all of them associated in *diphtherial* paralysis, a disease in which not only this direct stimulant of the spinal axis, but all indirect excitants, as electricity, tonics, and nutrients, are indicated. A striking illustration of the curative power of the remedy is furnished by a case reported by Dr. Maund, in which the patient had, besides

[1] BAYLE, Bibl. de Thérap., ii. 141.
[2] Arch. Gén., iii. 294.
[3] Am. Journ. of Med. Sci., vii. 334.
[4] Hospital Facts and Observations, Lond. 1830.
[5] Med.-Chir. Rev., July, 1839.
[6] Recherches, p. 267.
[7] An interesting essay on this subject by BUFALINI is contained in Dublin Quart. Journ., May, 1856, p. 492.

general paralysis of motion and sensation, impairment of the special senses, and mental imbecility. The cure was complete.[1]

The experiments and observations of Dr. Brown-Séquard confirm in the fullest manner the conclusions of experience, that strychnia is a remedy for those forms of paralysis in which the spinal nervous centre requires stimulation, including all which are now known as reflex paralysis, and those which depend upon general exhaustion, or any other cause by which the spinal marrow is deprived of its due supply of blood. They equally show that in those cases of paraplegia in which there are signs of congestion or inflammation of the spinal cord or its meninges, strychnia ought to be avoided as a most dangerous poison.

The *administration* of strychnia in paralytic affections should be very cautiously conducted. Beginning with one-twentieth, or from that to one-twelfth of a grain daily, the dose may be gradually increased until some jerking or tension is felt in the paralyzed muscles. At this point the remedy may be suspended, or its quantity diminished. Strychnia has been applied to the denuded cutis, but in this manner it causes severe pain, and is very apt to excite an erythematous inflammation of the adjacent skin; besides which its effects are uncertain. By the hypodermic method its operation is rendered more certain and prompt. But promptness is less to be aimed at in the use of this remedy than certainty and safety of action, which are both perfectly secured by its administration through the stomach. It has also been used in frictions to the sound skin by means of an ointment, so that about one grain of strychnia, or of its sulphate, shall be daily applied. The skin subjected to these frictions should be kept carefully clean by means of soap and water.[2] The paralyzed muscles may be covered with fomentations containing tincture of nux vomica, while strychnia is given internally.[3] The physiological experiments, of which the results have been above stated, prove that, as the medicine can act only through its contact with the nervous centres, it is to give needless pain and trouble to employ it hypodermically. The cures wrought in this manner by Courty[4] and others would have been quite as effectual had the medicine been administered in the ordinary manner. In local paralysis the case is different.

Amaurosis.—Strychnia was employed in this disease at an early date, by Dr. Middlemore, of Birmingham,[5] and also by Shortt, Liston, Guthrie, etc. The physician first named confined its use to those cases in which the retina is in a state of atony from some cause acting directly upon its texture through the medium of general debility of the system. He thought it peculiarly applicable, when the loss of vision was due to using the eyes by a very feeble light, as in the case of miners. He found but slight advantages comparatively from its internal use, but preferred its endermic application

[1] St. Andrew's Med. Grad Assoc., ii. 89.
[2] SANDRAS, Mal. Nerv., ii. 84.
[3] TROUSSEAU, Thérap., 5ème éd., i. 783.
[4] Bull. de l'Acad., xxix. 28.
[5] Diseases of the Eye, ii. 282.

to a blistered surface above the eyebrow. He commenced with the daily application of a quarter of a grain, and gradually increased this quantity to two grains, keeping the blisters open meanwhile by a dressing of savine cerate, and tempering the pain by mixing the medicine with a little flour or powdered opium. Under similar conditions, Petrequin cured several cases.[1] Miquel and Verlegh employed strychnia successfully by friction or inoculation around the orbit.[2] Werber cured diplopia and amaurosis from deranged innervation by the endermic method, and also by dropping into the eye a solution of strychnia, of one grain to half an ounce of water.[3] Griffin was equally successful in a case apparently of congestive amaurosis. After the failure of evacuant and depletory measures, one-twelfth of a grain of strychnia was at first given once and afterwards twice a day, until in the course of eight weeks as many grains had been taken. At the end of this period the cure was complete.[4] Sandras, who speaks highly of the use of strychnia in the form of amaurosis now described, advises that the vesication near to the eye should be made with strong ammonia mixed with lard, that it should be of small extent, and not renewed immediately upon the spot first occupied, lest a troublesome sore and an unsightly scar should result. The strychnia itself may be incorporated with the portion of lard or cerate which is used as a dressing for the blister.[5] Two cases of chronic amaurosis cured by the internal administration of strychnia are reported by Dr. Griffin.[6] Prof. Nagel, of Tübingen, has obtained the most satisfactory results from hypodermic injections of strychnia, in a great number of cases of amaurosis, not only of purely functional disorder, but of greater or less alteration of structure in the retina as demonstrated with the ophthalmoscope. Of course inflammatory affections of the eye are unsuitable for this medication, and also impairment of vision depending upon intra-cranial causes.[7] These results have been confirmed by several observers, among them Dr. Chisolm, of Baltimore, who also noted the rapid, and indeed in some cases almost sudden, improvement of the sight upon the hypodermic injection of strychnia.[8] These results have been corroborated by Prof. F. L. Parker, of South Carolina.[9] The hypodermic injection should at first consist of about one-sixtieth of a grain of strychnia. Nagel prefers its introduction near the eye, but Dr. Chisolm found it equally efficient when injected elsewhere. Other forms of local paralysis have been treated with hypodermic injections of strychnia by Barwell,[10] Hutchinson,[11] and others, but the results have been either negative or very slight. An interesting account is given by Mr. de Ricci, of Ballymahon, of an epidemic *night blindness* which prevailed in the work-house of that place, some cases of

[1] Bull. de Thérap., xv. 28, 286.
[2] Ibid., xxxiii. 350.
[3] Op. cit., p. 136.
[4] Dublin Quart. Journ., Aug. 1853.
[5] Op. cit., p. 249.
[6] Dublin Quart. Journ., Nov. 1858, p. 315.
[7] Med. Record, vi. 173.
[8] Am. Journ of Med. Sci., Jan. 1872, p. 29.
[9] Ibid., April, 1874, p. 472.
[10] Trans. Clinical Soc., iii. 139, 143.
[11] Phila. Med. Times, i. 277.

which were peculiarly intractable, and were only cured by the internal or the endermic application of the medicine.[1] Dr. Chisolm, above referred to, found it the most efficient remedy he had employed for this affection.

In *prolapsus of the rectum* Schwartz used the extract of nux vomica with great advantage, both for children and adults. For the former, he dissolved two grains in two drachms of water, and of this solution gave two or three drops to infants, and from six to fifteen drops to older children.[2] Duchaussoy used strychnia with perfect success in a case of four years' standing.[3] Mr. A. Johnson also effected a cure by applying one-sixteenth of a grain of strychnia upon a blistered surface over the coccyx. Koch, of Stuttgart, was equally successful in a case of fifteen years' duration, by means of injections of cold water containing twelve drops of the tincture of nux vomica. Foucher and Dolbeau found that ten or fifteen drops of a solution of strychnia, containing one part of the alkaloid to one thousand of water, and injected beneath the skin about a quarter of an inch from the margin of the anus, produced an immediate amendment in the affection, and in some instances the cure was perfected by a single operation.[4]

When *incontinence of urine*, or, on the other hand, *retention of urine*, depends upon impaired power in the muscular coat of the bladder from habitual distension, or from pressure by the uterus, the operation of strychnia is generally very efficient. The remedy appears to have been first proposed by Cerchiari, of Bologna, in cases occurring after parturition. Cory relates an instance of the sort in which the bladder regained its power after the second dose of one-sixteenth of a grain.[5] Solly employed it successfully in a case of incontinence of urine after lithotomy,[6] and Lecluyse, in retention of urine and consequent paralysis of the bladder, by injecting a solution of strychnia into this organ.[7] In that troublesome form of incontinence of urine which so commonly affects children, Mondière found the alcoholic extract of nux vomica better than all the other remedies he had employed, and, indeed, his experience coincides with that of Ribes, Guersent, Mauricet, and others.[8] Trousseau, however, thinks belladonna superior.

The writer last mentioned has treated *sexual impotence* successfully with strychnia. He was induced to employ it by observing its effects in the case of a man affected with paraplegia for three years, during all of which time the genital organs had lost their power. Under the use of the medicine their function, along with that of the muscles of the extremities, was re-established. Similar effects were noted in a second case of the like description, and also in a third, where the want of power appears to have been limited

[1] Dublin Quart. Journ., Feb. 1858, p. 46.
[2] Bull. de Thérap., xi. 31.
[3] Arch. Gén., 5ème ser., ii. 327.
[4] Bull. de Thérap., lx. 548.
[5] Lond. Med. Gaz., xxiii. 905.
[6] Ibid., Feb. 1849
[7] Month. Journ. of Med. Sci., Aug. 1850, p. 176.
[8] DIERBACH, Neueste Entdeckungen, ii. 532.

to the penis, and where, also, it was only remedied while the medicine was actually in use.[1] Magendie, and also Duclos, found it serviceable under like circumstances. The latter used the alcoholic extract in doses of a grain daily, and gradually increased them until eight were taken in a day. He found that it not only cured the sexual impotency, but also improved the digestion when the appetite was feeble, or the food occasioned gastric pain.

The diseases characterized by *excessive, or rather disordered, action*, in which strychnia has been employed with benefit, are more numerous than those which have been noticed. Even in *tetanus* its power has been unequivocally displayed. In 1847, Dr. Fell, of New York, published seven cases of tetanus, six of which were certainly of the traumatic variety, and which all recovered under its use. His plan of administering it was to give $\frac{1}{8}$ or $\frac{1}{10}$ of a grain, and in two hours $\frac{1}{16}$ gr., then reducing the dose still further, and only to the extent of producing specific signs of its influence after each one.[2] Dr. Kollock, also, relates a case of traumatic tetanus occurring in a negro girl, which was cured by strychnia, given in doses of $\frac{1}{12}$ gr. every two hours.[3] Another cure of the same disease by the same means is related by Dr. L. Bartlett.[4] The view which we are led by experiment and observation to adopt, that tetanic spasm implies hyperæmia of the spinal cord, seems not easily reconcilable with the facts just referred to. And yet, when it is remembered that the paralysis never follows traumatic tetanus, and that the absence of any lesions visible to the naked eye is the rule in fatal cases of the disease, it may be conjectured that as local stimulants dissipate forming inflammations of the skin and various other organs, so may strychnia act substitutively and overcome the lower degrees of spinal hyperæmia on which the symptoms of tetanus depend.

In *chorea* there is a strong evidence of its antispasmodic virtues. Attention was first attracted to its power in this affection by Rougier and by Trousseau. The former published ten cases of boys, between the ages of six and sixteen, who had suffered from the disease during various periods of from one month to four years. The duration of the treatment varied between one and eight weeks. Only one of the cases relapsed, and that was cured anew by the same means. In all of the cases the symptoms were at first aggravated. Rougier employed nux vomica, and began by giving minute doses, which he increased until the specific influence of the medicine began to be visible.[5] Trousseau preferred a solution of the sulphate of strychnia, of which each dose contained about one twenty-fifth of a grain of the salt. At first, one dose only was taken every day; after two or three days, two doses were given; and thus the quantity was very gradually increased until some itching of the scalp, which was generally the first sign of its action,

[1] Thérapeutique, 5ème éd., i. 783. [2] New York Journ., of Med., vii. 371.
[3] Amer. Journ. of Med. Sci., April, 1848, p. 316.
[4] Boston Med. and Surg. Journ., April, 1864, p. 234.
[5] Med. Times, August, 1844.

or some other indication of similar import, was observed. The essential condition of its salutary influence is the production of stiffness of the neck and lower jaw, and occasional convulsive jerkings of the limbs. As soon as these phenomena manifest themselves, the choreic movements are said to subside, and sometimes the disease is removed after a treatment of fifteen or twenty days.[1] It should be borne in mind that the author cited did not propose this remedy as an infallible specific, but insisted on the use of depletion or of iron, according as plethora or anæmia was present, or the administration of antispasmodics if the hysterical element predominated, or of quinia and digitalis if there was subacute rheumatism. Even with these qualifications it does not appear that strychnia has been regarded by the profession generally as an eligible remedy for chorea. Perhaps the results obtained by other physicians have not been like those of Trousseau. M. Sandras, indeed, implies as much, for he says that trials made for the purpose of testing his results have led to an opposite conclusion, and also that those who have witnessed the experiments of Trousseau declare that the chorea patients subjected to this method recovered neither quicker nor better than others.[2]

In *epilepsy*, nux vomica was asserted, even in the time of Murray, to be a valuable remedy; and in 1838, Chrestien, of Montpellier alleged that out of thirty cases treated by it, eight were entirely cured and the remainder benefited. Since then nearly all who have written concerning the disease have either made no mention of strychnia, or have only done so to condemn it. But in 1867, Mr. W. Tyrrell,[3] apparently unacquainted with the precedents to which we have referred, was led by the fact that conia, which controls the convulsions of strychnia, increases those of epilepsy, to conjecture that strychnia might be antidotal to epilepsy. Having treated sixty-nine cases with the medicine thus suggested to his mind, he found that in every case it exhibited a marked power in controlling and altering the convulsive attacks. He prescribed the medicine to be taken twice a day in doses of one-sixteenth of a grain. Subsequently[4] this gentleman confirmed his original statements by the results of a larger experience; but found that the cases most amenable to the remedy were such as occurred in highly nervous and excitable persons, and also cases of *petit mal*, occurring originally during infancy or childhood, and attended with impaired development of body and mind.

An interesting case of *spasm of the œsophagus* is related by Mathieu, of Lyons. It occurred in an hysterical woman, who was affected to such a degree that she was rapidly becoming emaciated and exhausted. All of the usual treatment adapted to the hysterical origin of the symptoms was employed in vain. Strychnia was then resorted to, and as soon as it developed its specific effects

[1] Thérapeutique, i. 785. [2] Maladies Nerveuses, ii. 525–6.
[3] Med Times and Gaz., May, 1867, p. 519.
[4] Times and Gazette, May, 1859, p. 488.

the œsophageal spasm ceased altogether, but the hysterical symptoms proper were unaffected.[1]

Kroyher, of Presburg, announced, some years ago, that minute doses of the tincture of nux vomica in aromatic water, or cherry-laurel water, formed a specific for the sympathetic *vomiting of pregnancy*. In many cases it proved successful within a week, or even less time.[2] Mr. Gream used the tincture with the best effects in *hay fever*. He gave from ten to twenty drops, three times a day.[3] The external use of equal parts of tincture of nux vomica and soap liniment is strongly recommended by Kissel in the local forms of *chronic rheumatism*.

Rœlants, of Rotterdam, has furnished a favorable account of the treatment of *facial neuralgia* by nux vomica. Twenty-five out of twenty-nine case were cured, and three of the remaining four were still under treatment. Old as well as recent cases yielded to the medicine with singular rapidity.[4] Tincture of nux vomica was recommended by Serres in *lead colic*, to be given in doses of from ten to thirty drops according to the course of the disease, and also to be administered in clysters, and applied to the abdomen on cataplasms.[5] Huss, of Stockholm, and Neligan, of Dublin, found it equally successful. More recently (1854), Swett, and also Buckley, of New York, spoke favorably of its effects. They found that it generally procured relief within forty-eight hours, the bowels acting and the pain subsiding. In *painful menstruation*, independent of blood disease, and of organic uterine affections, and in prolonged after-pains, it has been strongly recommended by Rademacher. He directed the tincture of nux vomica to be associated with tincture of castor in equal parts, and thirty drops of the mixture to be given five or six times a day.[6]

Murray refers to several writers who recommended nux vomica in *intermittent fever*, and Vogt[7] thinks that it has been wrongly neglected. He advised that it should be associated as a tonic with the true antiperiodic medicines.

There are several forms of *dyspepsia* in which this medicine has been found extremely useful by Schmidtmann, Voigtel, Horn, and other German physicians. The one in which it is most usefully employed was described by Rowland (1838), and is true *gastralgia*, a disease in which paroxysmal pains of various characters, but always intensely severe, are felt in the stomach, and radiate thence to the chest, hypochondria, and back. As the fit subsides, a copious eructation of gas, and of an insipid or acid liquid, takes place. Yet digestion and nutrition are unimpaired, and the bowels are much confined. Rowland gave a quarter of a grain of the watery extract of nux vomica three or four times a day. In other cases the stomach is habitually irritable, the digestion accompanied with pain of a neuralgic character, and the general aspect of the patient indicates an anæmic condition. In these cases, however, the gas-

[1] Abeille Méd., ix. 286.
[2] Med.-Chir. Rev., Jan. 1841, p. 231.
[3] Lancet, June 8, 1850.
[4] Archives Gén. de Méd., 4ème sér., iii. 92.
[5] Lancette Française, Dec. 1830.
[6] Bull. de Thérap., xlix. 557.
[7] Pharmakodynamik, i. 140.

tric irritability is such that the preparations of iron are not tolerated, and then, as Clarus has shown, the extract of nux vomica renders the stomach capable of supporting ferruginous remedies.[1] Huss, of Stockholm, employed the remedy successfully to relieve the gastric irritability which has everywhere been noticed, as a sequence of Asiatic cholera, and which appears to involve a sub-inflammatory element. Its most ordinary symptom is an uneasy gnawing pain at the pit of the stomach, and vomiting of the food. A grain of powdered nux vomica, with ten of magnesia, was given three or four times a day, and every third day the dose was increased by half a grain. The patients stated that they experienced after each dose a sense of relief in the stomach, and after ten or twelve days, they were free from pain.[2] Werber strongly recommends this remedy in the more ordinary form of dyspepsia, in which the biliary secretion is defective, the digestion slow, the appetite impaired, the bowels torpid, and the spirits depressed—a condition which is apt to follow exhausting causes of all kinds, excesses in study, or business, in eating, in drinking alcoholic liquors, tea, or coffee, and in venereal indulgence.

Closely connected with the last mentioned form of dyspepsia is simple *constipation*, or that which is independent of all inflammatory causes, and without signs of constitutional disturbance. It appears that nux vomica was first recommended for this complaint by Tessier.[3] Copland says that in cases apparently depending upon deficient tone of the muscular coat of the large bowels, and imperfect propelling power of the upper part of the rectum, he has seen benefit derived from combining the spirituous extract of nux vomica, or strychnia, with the pill of aloes and myrrh, or with the compound extract of colocynth.[4] Neligan found the extract useful in similar combinations, particularly in females, when the constipation was accompanied with a great secretion of flatus and colicky pains.[5] Trousseau recommended it particularly for the sluggishness of the bowels which affects old persons, or those who have become prematurely feeble, and whose digestion is consequently sluggish and laborious.[6] Werber confirmed these statements, adding that minute doses act more efficiently than large ones; and Dr. Peacock and Dr. Clark, of London, advise, under similar circumstances, the use of from one-sixth to one-half a grain of the extract in combination with the compound rhubard pill. Mr. Boult, of Bath, also found that pills made by the addition of half a grain of the extract of nux vomica to three-quarters of a grain of aloes, and as much rhubarb, were sufficient, in the dose of a single one, to produce a free evacuation of the bowels, and that they lost nothing of their original power for several months.[7] Oesterlen found the extract, applied by the endermic method, successful in overcoming obstinate constipation. In *spasmodic obstruction of the bowel*, Vidal pro-

[1] Arzneimittellehre, p. 604. [2] DIERBACH, Neueste Entdeck., ii. 527.
[3] MÉRAT and DE LENS, Dict., Suppl., p. 678.
[4] COPLAND'S Dictionary (Am. ed.), i. 475.
[5] Medicines, their Uses, etc., 4th ed., p. 446.
[6] Op. cit., p. 787. [7] BRAITHWAITE'S Retros. (Am. ed.), xviii. 116.

cured relief by using a sixteenth of a grain of strychnia every four hours. Dr. Parker, of Charleston, has reported a case of obstruction of the bowel which resisted a variety of purgative medicines and enemata, and only yielded to the administration of strychnia in the dose of one-twelfth of a grain, three times a day.[1] Homolle[2] is stated not only to have removed, by its means, impacted fæces, but actually to have relieved strangulated hernia, when the necessity of an operation seemed to be inevitable. A similar example of the apparent efficacy of strychnia in this affection is reported by M. Lopez.[3]

The tonic influence of this medicine upon the bowels is further shown by its efficacy in some forms of *dysentery*. In the last century Hagström employed powdered nux vomica in scruple doses, and in hundreds of instances with wonderful success. And Murray, from whom this statement is derived, refers to other confirmatory cases.[4] Hufeland also resorted to it with the happiest results in an epidemic of dysentery at Jena in 1795. He prescribed rather less than a grain of the extract every two hours. Rademacher found it necessary to give opium also in some cases. Mr. Vaux, of Ipswich, England, gave as much as seven grains of nux vomica three times a day, and reported his success as remarkably uniform.[5] Frisch prescribed it with advantage in subacute dysentery, and Recamier in *chronic diarrhœa*, as did also Nevins when the latter disease affected young persons.[6] In 1830 Dr. Bardsley published six cases illustrating the curative powers of strychnia in this disorder occurring in persons somewhat advanced in life and of feeble constitution, and very plausibly conjectured that it acts by restoring the tone of the affected parts. He prescribed the medicine in pilular form, and in the dose of one-sixth of a grain three times a day.[7]

Sulphate of strychnia has been used by M. Sée in the treatment of *epidemic cholera*. The cases in which this physician prescribed it were forty-seven in number, and their results are certainly not such as to encourage a repetition of the trial. According to M. Sée, the advantages of the remedy are that in moderately severe cases it controls the discharges, without producing, like opium and other stimulants, a subsequent violent reaction.[8] But this result is obtained equally well, if not better, by the administration of acetate of lead. Dr. Balfour,[9] however, claims that strychnia, in the dose of from one-eighth to one-quarter of a grain, every hour and a half or two hours, until its physiological effects begin to be manifested, may be used with great hope of success even in cases of the most complete collapse, and that, even when not successful, it relieves the most painful symptoms, the cramps. In so hopeless a condition as the collapse of cholera, a more desperate remedy, even, than strychnia should not be neglected, if it possesses, as this one certainly does, even a plausible support from reason and experience.

[1] Charleston Journal, xiii. 640.
[2] Op. cit., p. 787.
[3] Abeille Med., xiv. 253.
[4] Apparat. Med., i. 714.
[5] ARMSTRONG's Lectures, p. 409.
[6] Annuaire de Thérap., 1850, p. 22.
[7] Hospital Facts and Observations, p. 42.
[8] Bull. de Thérap., xlvii. 183.
[9] Lancet, January, 1867, p. 8.

Nux vomica was long ago recommended (*Murray*) as a remedy for *lumbrici*, and it is said to be commonly used, associated with drastics, by the inhabitants of the Dutch province of Overyssel to expel the *tapeworm*.[1] This is quite likely to be true, as all bitter medicines are more or less vermifuge, and this one, in addition, gives unnatural energy to the intestinal contractions.

Administration.—Nux vomica, divided by grating or filing, may be given in the dose of five grains three or four times a day. But its activity is too variable to render this an eligible form of administering it. The *alcoholic extract* is more convenient, and, when well prepared, more certain. Its dose is half a grain, gradually increased to three grains. The *tincture*, like nux vomica itself, is of uncertain strength, but is usually prescribed in doses of from five to twenty drops. The first dose of *strychnia* should be about one-twentieth, and should not exceed one-twelfth of a grain; it may be gradually and slowly increased until its effects are produced. It should always be diminished, at first, when a different sample of the drug is employed. It is usually made into pills with crumb of bread, or with conserve of roses, care being taken to divide it with accuracy. A convenient method, where its bitterness is not objectionable, is to dissolve a grain of strychnia in two fluidrachms of rectified spirit, with the aid of two minims of sulphuric, hydrochloric, or acetic acid, so that every ten minims of the solution shall contain one-twelfth of a grain of the salt of strychnia. For *hypodermic* injection a convenient solution is made by dissolving four grains of sulphate of strychnia in a fluidounce of water. Of this solution each minim contains the one hundred and twentieth of a grain of the salt. Three minims, or one-sixtieth of a grain of strychnia, is a convenient dose at first. It may very slowly and cautiously be increased so as to reach after several weeks one-sixth or one-fifth of a grain. But in all cases the modifying operation of idiosyncrasies must be regarded.

Antidotes.—From some experiments upon dogs, Dr. Pendell concluded that lard or other fat, taken before or along with strychnia, prevented its poisonous action.[2] But Dr. W. H. Hammond, on repeating the experiment by giving two grains of strychnia with lard to one dog, and without this addition to another, found that the former died, but the latter was uninjured.[3] Dr. Shaw, of Texas, saved the life of a patient who had swallowed from ten to fifteen grains of strychnia, mixed with food, by administering large draughts of sweet oil. The oil, however, acted as an emetic.[4] Under similar circumstances, milk has served as an antidote. (*Rifoldo.*) It was inferred from some experiments by Prof. Haughton, of Dublin, that nicotine has the power of retarding, and, in certain cases, of counteracting, the effects of strychnia upon frogs.[5] Dr. O'Reilly, of St. Louis, acting upon this suggestion,

[1] Plagge, Pharmakodynamik, p. 334.
[2] Am. Journ. of Med. Sci., Oct., 1855, p. 541.
[3] Ibid., Jan. 1857, p. 273.
[4] Ibid., April, 1856, p. 547.
[5] Am. Journ. of Med. Sci., April, 1857, p. 551.

successfully treated, by means of a strong infusion of tobacco, a man who had taken six grains of strychnia. The spasms were arrested, and were followed by extreme prostration; but the patient recovered. The same gentleman has furnished several striking illustrations in man of the control which nicotine exerts over the spasmodic phenomena occasioned by strychnia.[1] (Vid. *Tobacco.*) Dr. Harley determined experimentally that strychnia and wourali are also antagonistic in their operation.[2] Animal charcoal was proposed as an antidote by Mr. Chippendale.[3] In a case reported by him, four grains of morphia and as many of strychnia were taken, and very probably the morphia may have acted, rather than the charcoal subsequently administered, to prevent, or at least delay, the poisonous effects. Such, in fact, was what occurred in direct experiments made by Rifoldo-Rifaldi. A grain of strychnia was given to a dog, and in a few minutes afterwards a grain of morphia. The symptoms were slowly developed and slight, and the animal recovered.[4] A similar result was long since obtained by Pelletier and Caventou.[5] Chloroform, internally, has arrested the symptoms in man. A striking case has been reported by Mr. Leach.[6] Camphor is also alleged to be an antidote to this poison, by Dr. Arnett, of Louisiana, who states that he put an end to a violent tetanic attack by administering two fluidrachms of a saturated solution of camphor in whiskey at intervals of half an hour. Within two hours after the first dose, it is said, no unfavorable symptom remained.[7] Dr. Woakes has proved very satisfactorily, by experiments upon animals, that aconite is a physiological antidote to strychnia, completely neutralizing, when given in the proper dose, the poisonous operation of the latter.[8] We are not acquainted with any instance of the trial of this method in man. Dr. James St. Clair Gray[9], considering the physiological action of nitrite of amyl, conceived that it might be antidotal to strychnia, and accordingly he found that in rabbits and in dogs this action was to a certain extent exhibited. Dr. L. Brunton, also, confined two frogs, one of which had been poisoned with strychnia, in an atmosphere of amylic vapor; both animals remained perfectly quiescent.[10]

It is evident that of these so-called antidotes some must act, if at all, by preventing the absorption of the poison from the stomach, and others by counteracting the nervous derangement and excitement which result from its absorption. Opium, nicotina, and camphor in large doses are all sedatives of the nervous system.

TOXICODENDRON. Vid. *General Stimulants.*
ERGOTA. " *Emmenagogues.*
SODÆ BORAS. " *Irritants.*

[1] Am. Journ. of Med. Sci., Aug. 1862, p. 172.
[2] Archives Gén., Dec. 1856, p. 669.
[3] Times and Gaz., April, 1855, p. 423.
[4] Bull. de Thérap., xlix. 41.
[5] Journal Universel, Juin, 1819, p. 258.
[6] Times and Gaz., Nov. 1863, p. 487.
[7] Charleston Journal, xii. 86.
[8] Brit. Med. Journ., Oct. 1861.
[9] Strychnia; Glasgow, 1872.
[10] Centralbl. f. d. med. Wissensch., 1873, No. 44.

Class VIII.

GENERAL SEDATIVES.

It has been elsewhere remarked that the primary action of nearly all medicines is stimulant or exciting; and, indeed, the exceptions to this statement are so very few, that it has been doubted whether any really exist. Into this question, which is theoretical rather than practical, we do not propose to enter. From a therapeutical point of view it is easy to perceive that certain agents are endowed with the power of reducing the activity of one or more portions of the system, and that their predominant, if not their exclusive action, even upon the healthy organism, is of the same nature. There is, then, a class of sedative medicines. But, on narrowly examining it, we find that it is susceptible of subdivision.

Life is recognized to exist, in general terms, by functional movements; and as by stimulants we mean medicines which directly augment and quicken those movements, so, on the other hand, by sedatives we imply medicines which directly diminish and lower them. The portions of the economy which more immediately serve as measures of vital activity are the arterial and nervous systems, and experience has proved that certain agents depress the one or the other of these or both of them together. Of arterial sedatives there are two, digitalis and veratrum viride, the effect of which upon the system is primarily, but not exclusively, to reduce the frequency of the pulse. Of nervous sedatives the number is greater, including, in this work, aconite, hemlock, cocculus, bittersweet, tobacco, lobelia, and white hellebore. These medicines are usually ranked among narcotics, but differ from the latter by an entire absence from their operation of any stimulant element, or, as in the case of tobacco, in the great predominance of its sedative over its stimulant action, and also by their exerting no direct soporific influence. Under the title of General Sedatives we include cold, and prussic acid, the former of which, as soon as it has overcome the momentary antagonistic excitement which its immediate action produces, lowers the activity of the nervous and vascular organs, and, by its direct influence upon them, may extinguish life. The only other member of this subdivision, prussic acid, is even more a general sedative; for although its primary operation is probably upon the nervous system, it so immediately afterwards depresses the

heart, and every other vital part, that, in large doses, it tends directly to destroy life.

The substitution of one sedative medicine for another is not frequently advantageous, or even possible, in practice. There is little in common between the different articles of the class, if we except digitalis and veratrum viride in their primary action on the circulatory, and aconite and veratria in their primary action on the nervous system. But the two former affect the nervous system, and the two latter the circulatory system, secondarily as sedatives.

FRIGUS.—COLD.

Medical History.—The use of cold in the treatment of disease may be traced to the very earliest historical periods, and in the records or usages of every people. Savage and civilized nations have employed it, and it has been equally the instrument of physicians and the resource of quacks. Like almost all human arts, it has passed through alternate periods of popularity and oblivion, but the duration of the former seems disproportionately brief when compared with the latter. No other remedial agent has been subject to as many vicissitudes of fortune. This will be apparent even from the brief historical sketch which is about to be presented.

The refreshing influence of cold drinks is employed as a forcible image by Solomon.[1] In Egypt, where all the usages of common life were regulated by religious laws, bathing must have been very early an established custom, for reference is made to it in the books of Moses. Yet it is remarkable that among the numerous articles of Egyptian furniture that have been preserved to the present day, or which are represented in paintings, scarcely any belong to or illustrate the bath and its appliances. From Egypt cold bathing is said to have been introduced by Melampus into Greece, whence in course of time it was carried to Rome. It there reached its completest development and was surrounded by such circumstances of luxury as have rendered the very ruins of the baths among the most surprising and interesting relics of the Roman capital.

Hippocrates appears to have formed a very just idea of the remedial powers of cold. The following are among the most conspicuous of his allusions to the subject. Warm water, he remarks,[2] relaxes and debilitates, but cold occasions convulsions, tetanus, lividity, and febrile rigors; it is inimical to the bones, teeth, nerves, brain, and spinal marrow. Cold should be used in actual or threatened hemorrhage, and not upon, but around the source of the flow. Snow and ice are injurious to the chest, and provoke cough and hemorrhage. Again, he states[3] that it is useful in cutaneous diseases, and in boils produced by the chafing of the clothing, the arrest of the menses, of the perspiration, etc. Ulcerated chilbains

[1] Prov. xxv. 13.
[2] Ed. VAN DER LINDEN, i. 91.
[3] Edit. cit., i. 605.

are aggravated by it, but in gouty and rheumatic inflammations of the joints cold affusions subdue the inflammation and blunt the pain. But in this case it must be used with great circumspection. It is not profitable when applied to the rectum or uterus, nor when the urine is bloody; nor is it an appropriate dressing for indolent ulcers, for it hardens the skin and impedes suppuration; nor is it always safe in spasms and traumatic tetanus; but in the idiopathic form of the latter disease, when the patient is young and robust, and the weather warm, cold affusions produce a salutary reaction. This author also dwells upon the importance of cold drinks in fevers, and directs how they are to be prepared.[1]

Paul of Egina cautioned against the use of cold drinks in large quantities after food; and Rhazes afterwards renewed this precept, of which all experience confirms the correctness.[2] Aretæus[3] enumerates cold drinks among the causes of tonsillitis, colic, and dysentery, and a desire for them as one of the signs of inflammatory fever. He warns against yielding too readily to thirst in phrenitis, and recommends copious draughts of cold water after evacuation of the bowels in obstruction of these organs. Celsus repeats, almost in the very words of Hippocrates, the opinions and precepts of the Greek physician; but, so far as relates to the medicinal uses of cold, he adds scarcely anything of his own. He mentions, however, a certain Petro who covered his fever patients with a great many clothes, that he might excite both heat and thirst, whereupon he gave cold water to drink, and if it raised a sweat, he pronounced the patient out of danger.[4] This, it will be perceived, is nearly identical with the practice of administering cold drinks to patients under the process of "packing." Aëtius recommends cold affusions after long and hot journeys or fatigue. The same writer says that cold bathing is a marvellous remedy for menorrhagia and sexual debility. Paulus recommends holding the eyes open under water for weakness and dimness of sight. In the time of Augustus Cæsar a certain Antonius Musa employed cold fomentations and cold baths to cure the emperor of a disease of the liver and bowels,[5] and his success caused the hydriatic treatment to acquire a sudden and rapid, but short-lived popularity. In the following century it was revived again by Charmis, a native of Marseilles. Like modern hydropathists, he charged all physicians before his own time with ignorance. His method consisted in cold bathing, which he continued even during the winter season, and so wheedled his patients that, according to Pliny, even old men of consular rank grew vain of being seen to emerge from the water frozen almost stiff by the cold. He amassed a large fortune by means of his extortionate charges.[6] Galen wrote very fully upon the uses of cold.[7] He advises cold drinks when the stomach is overloaded, and when the bowels are confined, and recommends

[1] Op. cit., ii. 118.
[2] ADAMS's Comment., i. 67.
[3] De Causis, etc., Lugd. Bat. 1731.
[4] Book iii. chap. ix.
[5] LE CLERC, Hist. de la Méd., p. 556.
[6] Ibid., p. 584.
[7] BELL on Baths, etc., p. 196.

that water used by the sick should be boiled, as some modern sectaries also do, though without acknowledging the source of their precept. He speaks of the power of cold to arrest hemorrhage, to alleviate heat of the stomach, to palliate continued fevers, to promote perspiration, etc. Avicenna, and the Arabian writers generally, dwell with much emphasis on the virtues of cold water in febrile disorders, constipation, and some other affections of the bowels. Cold affusion was a favorite remedy among Oriental physicians, and travellers report that it still continues to be employed by them. Very probably they derived the practice immediately from the Arabians, several of whose medical writers advise the use of cold affusions in febrile and eruptive disorders, and also the internal use of cold drinks to promote diaphoresis. Alpinus relates, while he condemns, the custom among the Egyptians of administering large draughts of cold water to hasten the operation of purgatives, but he admits that these medicines are thereby made to operate in less than the usual dose.[1]

When, on the revival of learning, physicians applied themselves to rescue from forgetfulness the medical experience of earlier ages, a large number of treatises on the uses of water were published. This was during the fifteenth and sixteenth centuries. Among them the most eminent was that of Bacci, or Baccius, which will be again alluded to. Others were published by A. Lusitanus, Pisanelli, Monardes, etc., of whom Boyer observes[2] that their works give no countenance to the abuses which men of scanty knowledge, or evident charlatans, and even the public profess to found upon them. From the middle of the sixteenth century cold water became a fashionable remedy, and was very much employed externally; but its internal use was still more general, at first, indeed, almost exclusively among the higher classes, but afterwards among the populace also. The excesses which it occasioned were denounced by De Vega, who drew a striking picture of its evil effects, to which many princes and noblemen had fallen victims. In the seventeenth century a number of writers extolled the usefulness of cold drinks in febrile affections, and of cold enemata in various disorders of the pelvic viscera. Before this period the practice had been confined to the warm climates of Southern Europe, but it now invaded more northern regions. Van der Heyden, of Ghent, published in 1645 a treatise in which he endeavored to show that cold water is useful in indigestion, rheumatism, and gout, that it arrests commencing inflammation, hinders suppuration, and alleviates the pains of stone; also that cold affusions are excellent in hemicrania, and cold enemata in dysentery. Soon afterwards appeared at Copenhagen the treatise of Bartholinus, *De Nivis Usu medico*, which contains a summary of all that had been previously written upon the subject. At the close of the same century the publications of Floyer began to appear in Eng-

[1] De Medicinâ Ægypt., p. 285.
[2] Recherches sur l'Hydrothérapie. Par A. L. Boyer. Strasbourg, 1843.

land, and almost simultaneously the cold water treatment was revived in Italy, and rendered very popular by a charlatan named Magliano. The extravagances of his method indeed fell speedily into oblivion, but the treatment by cold water was adopted by a certain number of physicians. Between 1720 and 1730, Todaro, of Parma, and Crecenza, of Naples, renewed its vogue for acute and chronic diseases, internal as well as external. Gangrene was treated with snow; in apoplexy the patient was wrapped in a wet sheet, while cold was applied to the head, etc. But the extravagances of these empirics at length destroyed their popularity when it seemed so firmly established as to be proof against all disasters, and they and their method were forgotten by the public. Meanwhile, however, physicians profited by what seemed good in the latter, and prescribed a due regulation of its employment, as appears by the writings of Rosetti, Lanzani, and others.

At the beginning of the eighteenth century cold bathing was introduced into England as a remedy, by Floyer and Baynard.[1] The former was prompted thereto, as he expressly states, by reading of its use among the Romans and other ancient nations. These physicians confined their treatment almost exclusively to chronic diseases, and those especially of a rheumatic, scrofulous, or paralytic description. They were well acquainted with the diaphoretic powers of cold water, which, indeed, they seem to have got a hint of from the popular method of reducing the weight of jockeys, and which is thus described: "Dip the rider's shirt in cold water, and after it is put on very wet, lay the person in warm blankets to sweat him violently." The treatment of rachitic children was as follows: "As soon as the children are dipped they, with their wet clothes on, are wrapped up in warm blankets, over their head and whole body, and put immediately to bed, which instantly puts them into a violent sweat. In this they lie all night, till towards morning the clothes are taken off by degrees, so that they may cool gradually." About the same time, as was before mentioned, Lanzani, of Naples, published a treatise on the method of employing cold water in fevers and other diseases. He administered it internally, and combined with its use a regulated diet and exercise, and various hygienic means. At the same epoch also (1712), Hoffmann published his treatise *De Aqua universali Medicina*, and somewhat later that entitled *De Aqua frigida Potu salutari*, in which he celebrates the refrigerant and purifying virtues of this element. In the former essay he insists upon the use of cold water in fevers, visceral obstructions, excess or impurity of the humors, plethora, ophthalmia, catarrhs, etc.[2]

But a more important event, as measured by its ultimate consequences, was the publication, by S. Hahn, of his *Psychrolusia* (1738), and by J. S. Hahn (1745) of a treatise on the powers and properties of cold water. These physicians, father and son, lived at Schweidnitz, in Prussian Silesia, and not more than thirty miles from

[1] The History of Cold Bathing, etc. Reprint, 1844. [2] Op. Om., v. 201.

Græfenberg. Their works contain a full account of the medicinal uses of cold water, including its application to almost every known disease. Without entering into detail, it is sufficient to cite a single case to illustrate the treatment employed, its derivation from that of Floyer, and its no less clear parentage of the modern hydropathic system which, as was just stated, but lately flourished almost in the same locality. "A lady was affected in almost all her joints with gout, which had resisted every mode of treatment. At last she was treated in the following manner: Cold affusions and lotions upon the bare head and body; wrapping in sheets soaked in cold water, and which were kept constantly wet for the space of two nights and two days; she sweated and recovered." The method of Hahn found imitators in Germany, but, like its English model, soon fell into disrepute, and only continued to be employed by the Silesian horse-doctors in the service of their patients, both quadruped and biped. Mention is made by Geoffroy[1] of a Franciscan monk in Malta, who treated acute and chronic diseases very successfully with cold drinks. Indeed he allowed his patients no food whatever, and no nourishment but water. In dysentery and inflammations of the pelvic viscera, he prescribed enemata of ice water.

From this period until near the close of the eighteenth century there exists but little trace of the medicinal use of cold water, but at the last-mentioned date, Robert Jackson, and soon afterwards Currie, brought it once more into notice. The former employed cold affusions for the cure of fever as early as 1774,[2] and the latter used it for the same purpose in 1787. Both were led by fortuitous circumstances to the adoption of this practice; Jackson by learning that some twenty years before a number of patients on board a hospital ship had, in the delirium of fever, thrown themselves into the sea, and the survivors from drowning were restored to their senses. Currie was indebted to a paper published in 1786 by Dr. Wright, who therein mentions having successfully employed affusions of cold sea-water when he himself was ill with fever on shipboard some years before. The works of Currie and of Jackson will be referred to for illustrations of the treatment of various diseases by cold water. In spite of the interest which attached to their writings, heightened, as it was, by a contest between them for the honor of having revived so valuable a therapeutic agent, the method once more fell into comparative disuse. It certainly had ceased to form a part of the systematic treatment of either acute or chronic diseases, and to the greater number of practitioners was perhaps entirely unknown, when it once more rose into a higher repute than ever before, and was celebrated by charlatans and by not a few physicians in every part of the world as the rightful successor or supplanter of all previous medical systems. Yet its vogue is declining; the exaggerations of candid but too credulous inquirers, and the monstrous misrepresentation of avowed

[1] Mat. Med., i. 84.
[2] Treatise on the Fevers of Jamaica, 1791.

partisans, are rapidly shrinking into more rational proportions, and there is even reason to fear that the mischiefs of the system will cause its benefits to be forgotten.

The last *avatar* of the watery divinity, whose career has just been sketched, is represented by Vincent Priessnitz, the keeper of a wretched road-side inn at Græfenberg, in Austrian Silesia. This peasant seems to have possessed much native shrewdness, which enabled him to make use of some vague notions gleaned among the neighboring shepherds, who treated many of their injuries and ailments with cold water, precisely as Hahn had done a century before. They, however, imagined that the virtue of the application was communicated by certain mystical ceremonies, such as had been practised three hundred years earlier by the contemporaries of Ambrose Paré. Like that great surgeon, the peasant innkeeper divined in what the curative power of the treatment resided, and immediately began to employ it for his own profit. Accompanied by his brother, heralded by his fame as a water-curer, and with his sponges on his back, he traversed the mountains which divide Græfenberg from Prussian Silesia, visiting the sick in the villages, giving them advice, and employing his remedy for the relief of sprains, bruises, etc., in men, and for the cure of lame horses. Although these acts were contrary to law, they were performed in spite of the police, and the itinerant quack-salver soon acquired all the celebrity and honor which persecution usually confers upon the meanest persons. This persecution was zealously promoted by the physicians of the neighborhood, who, being unable to deny results which were palpable to every one, alleged that the sponges of Priessnitz were medicated. They even caused the wonder-working implements to be seized, in the hope of detecting in them some medicinal preparation, but when, after tearing them to pieces, nothing could be discovered, these ill-advised zealots found themselves the laughing-stocks of the whole country. The rude pathology of the itinerant healers was the popular one, the humoral. This faith procured a ready acquiescence in measures which were declared all-powerful to purge the blood of its peccant humors, and which were to purify the system by means of baths and frictions and forced sweats. A certain professor, Oertel, in 1828, fell in with Priessnitz, and advised him to add the internal use of cold water to his other curative means, and, not content with this, published a work setting forth the virtues of a system of which the world might otherwise have remained in ignorance, and but for which the water-cure mania might never have become epidemic. Very soon the number of patients at Græfenberg multiplied exceedingly, and the vogue of its curative method spread over Europe and America. Men of rank and influence, who had been restored to health by its discipline, procured for Priessnitz the right of creating a water-cure establishment, which became the model after which numerous others were formed in every part of Europe and in the United States. Its proprietor grew rich, but although he was taught some measure of prudence by the fatal results of his earlier

practice, he continued to the last wedded to his ignorance, and his boorish nature remained unsoftened by his intercourse with the educated and refined persons who sought for health at his hands.[1]

It is worthy of remark, as an illustration of how little theoretical dogmas have to do with a belief in, or a submission to, the practice with which they are united, that the system of Priessnitz—the most notable illustration that could be conceived of the dogma *contraria contrariis curantur*—should have arisen about the same time and out of the same nation in which *similia similibus medentur* was proclaimed as an infallible and universal principle. Nor is it less remarkable, as an illustration of the effrontery of medical impostors, that many of the sectaries of the latter heresy are the boldest trumpeters of the former, although each necessarily excludes and contradicts the other. The interpreter of nature, indeed, adopts neither dogma; for he perceives that neither forms the principles of more than a limited class of facts. As exclusive systems, he rejects both, but is equally ready to adopt the perturbating method of Priessnitz or to imitate Hahnemann by withholding all medicine, when either seems more appropriate than the medicinal treatment which, in the great majority of instances, effects the quickest, safest, and most agreeable cure.

Surgical History.—The ancients do not appear to have employed cold, as an external agent in surgical affections, to as great an extent as modern physicians. Traces can nevertheless be found of their partial acquaintance with its value. Besides those which have been mentioned incidentally, may be cited the testimony of Celsus, who mentions the power of cold water in arresting hemorrhage,[2] and that a slight wound is helped by laying on it a sponge squeezed out of cold water. But, he adds, in whatever way it is put on, it does good no longer than it is moist. There is no prominent mention of the subject by surgical writers of note, during the long period that elapsed between the time of Galen and the fourteenth century. The gross polypharmacy which had so long prevailed, then began to be supplanted by an affected simplicity of treatment. Wounds, ulcers, and many cutaneous affections were treated by water alone, or by water in which some unimportant substance had been dissolved, and which was dignified by a singular or sonorous name. But it was not until the middle of the sixteenth century, after the return of the French from the Italian wars of Francis I., that the value of cold water was recognized in the treatment of injuries and wounds.[3] Ambrose Paré contributed not a little to make the method generally accepted, although he himself adopted it reluctantly, because it was generally practised by quacks, and disfigured by superstitious practices. A few years later (1570), Palazzo published a treatise on "the true method" of curing wounds with pure water and pledgets of linen, in which he holds up to ridicule the charms and superstitious observances which

[1] SCHEDEL, Examen Clinique de l'Hydrothérapie, Paris, 1845.
[2] Book v. ch. i. and xxvi.
[3] PERCY, Dict. de Méd., tom. x.

were popularly thought to make the applications useful. In 1601, Martel wrote an apology for his own use of cold water, in which he defended the practice against the attacks of those who stigmatized it as unprofessional. His estimate of the plan he expressed in the words: "I consider that keeping wounds clean is one of the chief means of promoting their cure; now it is certain that water cleanses and purifies them thoroughly. By its coldness it prevents inflammation, moderates the acrimony of the humors, etc." According to Percy, the employment of cold water was gradually supplanted, in the northern part of Europe at least, by a variety of vain or superstitious practices, including the use of the famous sympathetic powder. In the milder climate of Provence and Italy, its vogue was of longer duration.

About the beginning of the last century, Sir John Floyer alluded to the use of cold water in surgery for the purpose of arresting hemorrhage, and preventing hemorrhage after wounds; and Smith, in his *Curiosities of Common Water*,[1] says, "Cold water is an absolute cure for small cuts in the fingers or other parts." After adjusting and bandaging the wound, he directs the following treatment: "Double a linen rag five or six times, dip it in cold water, and apply it to the part, *binding it on fast*. This, by preventing inflammation and a flux of humors, will give nature time soon to heal it without any other application." The same author speaks also of its usefulness in lacerated wounds, and in strains and bruises, to which he directs it to be applied by keeping "the part in a tub of cold water for about two hours," or by laying to the part folded towels dipped in cold water. About the same time (1713) Sancassini, of Venice, published a treatise in which he says of the use of cold water for wounds, "It prevents any interference with nature, who is, after all, their true healer."[2]

It would appear that the use of cold water in surgery again fell into disuse, according to Percy, for the *fifth* time, and was very little employed until 1785, when its vogue began a new career. A number of officers and soldiers of the French army were wounded at Strasburg by the bursting of a cannon, and were very successfully treated by a quack, who used cold water only for the cure. A similar accident occurred soon afterwards, and the same treatment was again employed, but on this occasion by Lombard, who, together with Percy, caused the practice to be very generally accepted. So strong was Percy's persuasion of its value, that he declared he would have abandoned the practice of surgery, had he been denied the use of water-dressings. Their advantages were preeminent in the treatment of lacerated wounds involving fibrous structures. He boasts that by means of water alone, he preserved limbs which nothing else could have saved from amputation. By water more or less cold, according to the external temperature, and applied in baths, on sponges, or on compresses, he prevented or moderated inflammatory symptoms, and brought about cures with

[1] 4th edit., 1723. [2] A. AMUSSAT, Thèse, 1850.

which no others could be compared. This method of treatment was, as has been stated, revived, and became general during the wars of the French Republic and Empire, and although used on many occasions because the customary dressings could not be procured, yet the army surgeons were unanimous in its praise, and preferred it to less simple measures. Larrey speaks of the great success which attended the use of cold sea-water as a surgical dressing on the march of the French army across the desert which divides Syria from Egypt. After the battle of Baylen, in Spain, an immense number of wounded were to be cared for, but except linen dressings, wet with water, none could be obtained. Yet out of five hundred patients not more than seven or eight were attacked with gangrene, and only two with tetanus. Guthrie, whose field of observation was adjacent, and not less extensive, was accustomed to treat all wounds of the soft parts, in persons of a good constitution, by cold water applied over a dressing of simple ointment, and kept cool by constant renewal. But he soon learned that the method was not of universal application. Some patients suffered from the sensation of cold, and a still greater number did not continue to be benefited by its operation. His practice, therefore, was to discontinue the application whenever it appeared to produce chilliness or pain, when the parts became callous by its use, and when it seemed to check suppuration unduly. These views were systematized and more extensively applied by Macartney.

During the long peace which followed the year 1815, there was little occasion to resort to cold water dressings in military surgery, and they seem to have again fallen almost completely into disuse. The next revival of their employment is perhaps traceable to the notoriety of the Silesian water-cure. It was, at least, several years posterior to the establishment of the latter in 1834, that Josse, of Amiens, employed with great success continuous irrigations in various inflammatory affections and injuries. According to the published account of his experience, it would seem to have been not only exempt from accident, but even remarkably successful. Mayor, of Geneva, Liston, and Malgaigne, attributed excellent results to the treatment of surgical affections by cold water. The last preferred irrigation to other methods. He, as well as Nélaton, and many other surgeons, considered it as chiefly applicable to contused and lacerated wounds of the head and extremities.

In spite of the use of the cold water dressing by so many distinguished men, at so many different periods, its last revival was fated to the same issue as preceding ones. On account, as Amussat suggests, of the care and caution which the method requires, and especially of the evils which it sometimes occasioned, it has been gradually once more abandoned by the most eminent surgeons, and is now very rarely used in hospital practice.

Action.—The temperature of the human body varies with that of the surrounding medium. In the mouth and rectum it is about 98° F., and in the blood, according to Magendie, 102° F. Inflammatory diseases may raise it to 104° or 106°, and in scarlet fever

it sometimes reaches 112°. In malignant cholera, on the other hand, the temperature of the mouth has fallen as low as 77°.[1]

In health, the animal temperature is very nearly uniform, owing to the combined influence of food and the interchange of caloric with surrounding objects; but if these influences are suspended, and the outer air grows cooler, the temperature of the body may fall considerably. To maintain a moderate and equable degree of warmth in the system clothing is employed, and varied with the season. The warmest material for clothing, that is to say, the least perfect conductor of heat, is made of furs or feathers; silk follows next in order, then wool, cotton, and finally linen. The thickness of a garment made of any among these materials, is of course an important element in estimating its power of retaining the animal heat, so that the better conductor may make the warmer garment owing to its thicker and closer texture. Cold air abstracts heat chiefly from the surface of the body. Water also absorbs internal heat, when employed in the form of cold drinks and cold enemata.

The exhalation of aqueous vapor from the lungs and skin is the principal means by which the animal temperature is lowered; but the activity of this process depends upon the hygrometric state of the atmosphere. Therefore, warm and moist air augments the suffering from heat in summer, while cold and damp air produces a corresponding increase of distress in winter. In the latter season dry air is the most agreeable and healthful, when the temperature is at or near the freezing point, and in summer, also, under almost all the ordinary conditions of heat at that season. Cold and dryness combined give rise to a copious exhalation of aqueous vapor, as well as of heat from the body, and make, therefore, a large demand upon its nutritive function to supply the loss. This is one cause of the more vigorous appetite and digestion enjoyed in winter. In summer, on the other hand, the loss consists in a much larger proportion of fluids, particularly of perspiration, hence the craving for liquids, and the desire to drink them cold in order to moderate the painful accumulation of heat within the system.

When the body is exposed to a moderate degree of cold, the skin at first grows more ruddy, and the sensation of coldness is felt in the fingers, the tip of the nose, the ears, and other parts which are comparatively unprotected, and are remote from the central organ of the circulation, and, owing to the smallness of their mass, are readily exhausted of their caloric. If the cold acts upon the entire surface of the body, as in a bath at 60° F., for example, the temperature of the hand may fall from 98° to 72°, while the interior of the body probably does not change its temperature at all. Dr. Speek, while immersed in a bath as high as the breast, received upon his head a stream of water from a height of nine feet. The temperature of the water was between 68° and 73°, and the duration of the bath from six to twelve minutes. During the experiments a thermometer bulb was held in the mouth. This instrument

[1] MITSCHERLICH, op. cit., i. 401.

indicated a diminished temperature of between 1.08° and 2.89°, and the loss of caloric was greatest when the water was coolest.[1] As the temperature of the body falls, the skin grows pale and shrivelled, and has more or less of the appearance known as goose-flesh, and the nipples and the penis are shrunken. Whenever a part thus loses its volume, the capillary vessels no longer supply it so abundantly with blood, and to this circumstance, and to the absence, or at least the diminution, of the calorifying processes which result therefrom, must be attributed the sinking of the temperature. To the same cause, probably, may be ascribed the diminution which takes place in the consumption of oxygen, and in the excretion of urea under the influence of cold. The influence upon the pulse of cold applied internally in the form of cold water, has been studied experimentally by Lehmann,[2] and by Dr. H. Bence Jones, and Mr. H. Dickinson,[3] who all found it lowered in a degree proportioned to the coldness of the water. The douche has also a more marked influence than other baths, especially when the volume and shock of the water are great. The sensibility is also lessened by the application of cold to the whole surface of the body, and when it exceeds a moderate degree numbness is produced. At the same time all of the secreting organs perform their functions imperfectly, and the muscular system is more or less torpid.[4] The operation is, however, followed by an increased discharge of urine.

The inspiration of cold air produces marked effects. It acts more powerfully upon the nasal passages than upon the trachea and its branches, because in the latter it is tempered as well by admixture with the expired air, as by the heat of the parts themselves. Dry air abstracts caloric from the lungs more rapidly than moist air, because it more readily absorbs the pulmonary exhalation; but this cooling process is more than compensated for by the greater proportionate quantity of oxygen which such air supplies to the blood, and by the slighter abstraction of caloric which it makes directly from the surface of the body and of the respiratory mucous membrane. But if dry, cold air is inspired immediately after the respiration of warm air, the former acts as an irritant upon the relaxed mucous membrane, checking its secretion and often causing it to inflame. The danger of this result is greatly increased when the air is both cold and damp. It then acts not only as a local irritant, but also by abstracting heat from the surface of the whole body; it lessens that power of reaction which, when the air is dry, tends to ward off the injurious local effects of cold. Furthermore, it drives the blood inwards upon the organs of the trunk, and disposes them still further to inflammatory disease.

Ice, *snow*, and very *cold water*, *taken internally*, produce phenomena which vary only in degree. The ordinary effects are a sense of coldness in the mouth, throat, and stomach, and more rarely, a general shuddering, and a slight diminution of the frequency of the

[1] Arch. der wissent. Heilkunde, v. 422.
[2] Ibid., i. 521.
[3] Times and Gaz., April, 1857, p. 421.
[4] MITSCHERLICH, op. cit., i. 404.

pulse and of the heat of the body. In large quantities they may produce pain in the stomach, trismus, various spasmodic phenomena, and even sudden death; in other cases vomiting, decided chill, and occasionally inflammation of the stomach and congestion of the lungs or brain. A permanent sedative action is not to be looked for, but, on the contrary, the secondary effect of a draught of cold water is to increase the animal heat, quicken the pulse, and augment the perspiration.[1] The conditions which favor the injurious action of cold drinks are, as Rush first pointed out,[2] general heat of the body, emptiness of the stomach, the large quantity of liquid taken at a time, and the low temperature of this liquid. These effects, which are remarkably frequent in the United States, have been amply illustrated by Rush, Brewster,[3] Carroll,[4] and later American writers. The symptoms, as described by Brewster, are these: Soon after the patient has swallowed the cold water, he feels an uneasy sensation about the scrobiculus cordis, which, gradually increasing, is soon converted into violent lancinating pains which extend all through the abdomen and thorax. Breathing produces as much distress as in pleurisy, and the patient describes his pain to be as if a cord were bound tightly around his stomach, or as if sharp-pointed instruments were penetrating it. It then becomes more intense, and assumes a paroxysmal spasmodic form, which has been compared to the throes of labor. As the suffering grows more excruciating, the patient bends himself almost double in order to obtain relief, and writhes in the most indescribable agonies. If no assistance is afforded, he may become delirious. The pulse, though in some instances thready, is very hard when examined closely; the face is excessively red; the eyeballs glare. These symptoms gradually subside, and the patient falls into a lethargic coma, and lies perfectly easy. The jaws are now fixed; deglutition is interrupted; respiration is slow and stertorous; the pulse is gone; there is a sluggish circulation, with cold sweats, a pallid surface, and singultus generally closes the scene. If death does not take place, violent reaction commonly ensues, with general fever, and congestion of internal organs, particularly of the brain.[5]

The transient application of cold to the human body develops the peculiar effects of this agent so slightly that they are scarcely cognizable before the phenomena of reaction appear. The impression seems, indeed, almost like that of a direct stimulant. The involuntary muscles are thrown into active movement, the surface to which the cold is applied becomes highly colored with blood, particularly when it is of considerable extent and unused to receive external impressions, as in those parts which are habitually pro-

[1] MITSCHERLICH, op. cit., i. 406; GUERARD, Bullet. de l'Acad. de Méd., vii. 422.
[2] Med. Obs. and Inquir., i. 193.
[3] Philada. Journ. of the Med. and Phys. Sci., xi. 99.
[4] Ibid., xiii. 122.
[5] Compare Currie "On the disease that arises from drinking cold liquids, or using the cold bath, after severe exercise." Op. cit., i. 97.

tected by clothing. By its stimulant influence the cold weather of autumn and the early part of winter increases the activity of nearly all the functions. The fat and flesh increase, and the stools become less abundant and more consistent, while the fluids of the economy, instead of finding an outlet on the skin, are secreted more abundantly by the kidneys, so that the urine becomes copious and watery.

Cold air abstracts heat gradually from the parts of the body with which it comes in contact, from the skin, that is, and from the mucous membrane of the air-passages. When the temperature of the atmosphere is between 64° and 68° F. and the clothing is moderately warm, an almost constant temperature of the body is maintained. But when the air is cooler, it becomes necessary to protect the body with additional clothing, and to maintain its temperature by means of exercise and food. A still lower degree of external cold prevents the due renewal of lost caloric, and congelation follows. Gradually the ears, nose, chin, hands, and feet become insensible, then stiff, red, and painful, but afterwards dry, pale, and insensible. The nails first grow bluish, the teeth chatter, the whole body is restless and shivering, the chest is constricted, the breathing hard, the circulation sluggish, the movements painful; congestion of the internal organs takes place, exhaustion follows, the senses become obtuse, and by degrees all signs of life vanish. When the abstraction of heat takes place rapidly, sleep is induced which tends to pass into insensibility, and sometimes into death. The body is pale, and feels hard and cold; the features are usually calm but sometimes distorted; the mouth is shut, the feet and limbs are drawn up, the eyelids open, the cornea is turbid, and the excrements are no longer discharged. But even this degree of general congelation is not always fatal, but is attended with such a degree of torpor only as does not entirely preclude recovery, provided that heat be gradually and systematically applied. Humboldt showed that when the irritability of a frog's leg is diminished by cold, it can nevertheless be again revived by a gradual application of warmth, while under the sudden or rapid restoration of heat it displays only a brief and feeble vitality.

The more strictly *local* effects of severe cold are observed in the parts above enumerated, as those which first suffer from its general application, the nose, ears, fingers, etc. After having become insensible, the frozen portions are either covered with blisters, or the color of the skin changes to livid or black, showing that gangrene has set in, which, if the cause continues to operate, merges into sphacelus; the part appears to the sufferer singularly heavy, and the epidermis, when peeled off, shows the livid and marbled chorion beneath. The flesh then grows soft and exhales a putrid smell; and the fingers, the toes, or a whole limb, even, may perish and separate spontaneously from the body. The mechanical effects of cold are therefore closely analogous to those produced by inflammation, and in either case arise from slowness of the circulation of the blood, or its retardation in the affected part.

After death from cold alone the external parts are generally pale and bloodless, with diffused patches of bluish redness on the more dependent parts; the brain is generally pale from the absence of blood, which is also deficient within the abdomen, while the lungs are usually engorged, and the heart, especially on the left side, is distended with blood, as are also the large vessels attached to it. The blood itself is less dark in color than is usual after death, and speedily becomes brighter on exposure to the air.

The action of cold upon the animal economy varies according to the conditions of *rest* or *motion* of those who are subjected to it. Its effects in the first case have already been pointed out. They are of a depressing, benumbing, and debilitating character. But the same degree of cold will produce the very opposite effects upon a person in active motion. It will develop color, strength, and warmth, instead of producing pallor, feebleness, and coldness, activity instead of torpor, vivacity instead of dulness. Under its influence the appetite grows keen and the digestion vigorous—life exhibits its perfect energy. On the other hand, when the body at rest is exposed to cold air in motion, the ordinary effects of cold are greatly intensified. The air rapidly carries away the heat of the body, and excites severe pain wherever it comes in contact with the skin. A slight degree of cold, or what, for the present purpose, is the same thing, a partial application of severe cold to the surface of the body, acts, at least indirectly, as a stimulus, through the reflex irritation it excites. This may be well illustrated by the fact that the cold hand placed upon the abdomen of a pregnant female will excite strong contractions of the womb; dashing cold water upon the feet or walking upon a cold pavement, has been used even from ancient times to procure relief from constipation; a few drops of water sprinkled in the face is a popular method of exciting the respiratory movements and restoring the consciousness of persons in a swoon; the same expedient is resorted to for the purpose of establishing respiration in feeble and asphyxiated infants at birth; cold affusions are employed to arouse persons from narcotism; and animals in the apparent death of hybernation may be revived by the same means.

All *strong emotion* produces more or less insensibility to cold. Acute pain, deep study, fixed attention, the excitement of hope, of emulation, of ambition, of anger, a deep sense of danger, violent terror, the morbid fixedness of ideas in monomania, the rapid and tumultuous flow of the thoughts in mania—all of these and their kindred conditions destroy, in a great measure, the sensibility to cold, and even seem to lessen its hurtful influence. The former effect is familiar to every one who has had charge of the insane, whom it is not unusual to see moping or raving in a state perhaps of perfect nudity, yet without apparent suffering, when the temperature of the air is such as to chill their attendants thoroughly. Cases of this sort seem, indeed, to prove that no small part of the ordinary suffering from a low temperature is due to the depression of the system which the first painful sensations of cold produce.

Every one must have observed how rapidly the suffering from cold augments under the pain of a suppressed desire to urinate, and how much less the cold is felt immediately after that desire is gratified.

Age modifies materially the action of cold upon the living organism. Those ages which are most distinguished by feebleness present the greatest number of examples of its hurtful effects. The new-born infant feels its impression perhaps more painfully than any other person. The aged, having completed the cycle of life, return in many respects to the condition of infancy, and in none more than in extreme susceptibility to cold. The mortuary registers show a very remarkable increase of deaths among the aged and the very young whenever the winter is unusually severe. In fact, not to multiply illustrations, it may be stated in general terms that whatever weakens vitality augments the injurious influence of cold upon animal life.

The effects of cold have been illustrated on a large scale in the annals of military expeditions undertaken in the winter season. Such were the campaigns of Alexander the Great, in the North of Asia; of Xenophon, during the retreat of the Ten Thousand; of Tamerlane, when he issued from the wilderness to invade Russia; of Charles XII., in the barren and ice-bound steppes of the Ukraine; and of the Marshal of Belle Isle, who left 4000 of his men victims to cold and hunger on the hills of Bohemia. But the most memorable illustration is to be found in the history of the invasion of Russia by Napoleon. Out of a well-appointed army of four hundred thousand men which invaded Russia, scarcely thirty thousand recrossed the Niemen. The rest had nearly all perished by cold and famine. On the retreat from the Beresina to Wilna, says a historian of this disastrous campaign,[1] the soldiers, oppressed with weariness, gave themselves up to the seductive approaches of sleep; some were even indifferent to death. Many had their limbs frozen, and were but too happy to escape thus alive; some, stopping to obey a call of nature, perished where they halted. After the pillage of Kowno, eight hundred intoxicated men slept in the snow, and never woke again. Horsemen who had been obliged to wear their boots for several days together were surprised, at the end of this time, to find their toes or feet frozen. Sentinels were frozen stiff and motionless at their posts. Comrades were obliged to warn one another of the state of their ears and noses, for the vitality of these organs was frequently destroyed without the least consciousness on the part of the sufferers.

Remedial Operation.—The sketch that has now been given of the properties of cold in its relation to animal life renders it evident that the mode of its action is not simple and uniform, but multiple and various, according to the circumstances under which it operates. According to the nature of these, cold may be refrigerant, excitant, sedative, astringent, tonic, debilitating, or

[1] MORICHEAU-BEAUPRÉ, Effets du Froid, 1817.

perturbating. Its *refrigerant* property renders it applicable to all cases in which the heat of the whole or any part of the body is excessive, and enables it to check inflammatory processes tending to disorganization or other substantial derangement. In proportion to the suddenness of its application, cold becomes a *stimulant*, indirectly, however, through the reaction which follows its contact with the body. It acts upon the general sensibility to arouse the whole system to greater activity, as in cases of suspended animation, of paralysis, or of atony affecting particular organs. Cold is a powerful *sedative* by means of its prolonged influence upon the whole or any portion of the body, relieving the pain, heat, and swelling of local inflammation or of determination of blood, and indirectly subduing the excitement of the nervous and circulatory systems dependent upon these causes. This property may be illustrated by the pale and shrivelled aspect of parts subjected to cold, and by the readiness with which erectile tissues shrink under its influence. Pathological facts may be cited to the same effect. It also acts through the impression which it makes upon the vaso-motor nerves, causing a contraction of the bloodvessels; and this is often an excito-motory operation. The flow of the menses, of the milk, or the perspiration, is interrupted by cold applied to the feet or other remote parts of the skin. In Italy, it is said that the peasant women arrest the secretion of milk in their breasts by having very cold water dashed between the shoulders, and prevent its establishment after childbirth by means of cold applications to the mammæ.

The *astringent* action of cold is, for the most part, a mechanical effect; it is, however, carried further in living than in dead matter, because the fluids are more easily moved in the former than in the latter, and because a sedative influence accompanies it. Hence it empties an inflamed or swollen part of its fluids by a direct mechanical or constringing power, and at the same time subdues the local excitement which invites the afflux of blood. Hence, too, it gives tone to the tissues which it constringes, by removing from them the fluids by which they were distended and weakened.

The *tonic* action ascribed to cold may be regarded as a combination in various degrees of its sedative, astringent, and stimulant qualities. In proportion as a part or the whole of the body is unduly subjected to external influences, so may it be said to be in a state of irritability which strongly inclines it to become diseased. Cold, if duly applied, reduces this morbid over-action, imparting at the same time greater firmness of tissue and activity of function; in other words, increasing the tone. Such will be the effect when the system possesses a proper share of resiliency; but if it is unable to react under the impression of cold, neither will stimulant effects immediately follow the application of cold, nor yet the tonic results which are, as it were, the signs of an aggregate of separate stimulations. The sedative effects will remain predominant. Hence it is evident, as also direct experience teaches, that cold applications are dangerous when the system is exhausted or debilitated,

and useful when excitement or strength exists. According to the aphorism of Sanctorius, *Lavacra frigida corpora robusta calefaciunt, debilia refrigerant.* Cold has also a mode of action which seems combined of its stimulant and *antispasmodic* properties. Perhaps it possesses the latter in virtue only of the former. The sudden impression of cold water will generally suspend functional spasmodic paroxysms, whether general or partial, and when these are chronic and habitual, will often, by constant use, remove them entirely. In the former case the antispasmodic action is immediate and direct, but in the latter the tonic property of cold is more distinct.

Remedial Employment. *Continued Fevers.*—Galen, according to Baccius,[1] states that a cold bath taken after a warm one cures ephemeral, putrid, and the greater number of hectic fevers, and that the former alone is frequently of great service in fevers, provided the patient have strength enough, if there is a deposit in the urine, and the important organs are free from disease. These recommendations, guarded as they are, were still further qualified by requiring that the patient should be young, the weather hot and dry, and the fever violent. As will appear in the sequel, the most judicious among those who have recently employed cold water in the treatment of febrile affections, reached, by means of their own experience, conclusions almost identical with those of Galen. The method was not confined to the Eastern hemisphere. Americus Vespuccius relates that the aborigines of this country, when attacked with fever, were accustomed to bathe in the coldest water they could procure, and, immediately on leaving it, to run as far as possible, and use violent exercise before a hot fire; after which they slept, and awaked free from fever. Without dwelling longer upon the remote history of this branch of the subject, it is sufficient to state the results of modern experience in the treatment of fevers by cold, and especially by cold water.

Probably the use of this remedy is beneficial during the periods of augment and station in nearly all the graver forms of idiopathic fever, or when it assumes a typhoid type during one period or another of its progress. Most of the cases of "inflammatory fever" (*Synocha*, Cullen) which are contained in the works of ancient and modern writers, were probably examples of symptomatic fever, the source of which was unsuspected, or at least undetermined. In this, however, as indeed in all forms of fever, whether idiopathic or symptomatic, cold has its appropriate uses, which are especially to moderate the heat of head, cerebral excitement, and thirst, which are common to them all. But it is in the graver forms of fever, and especially in *typhus* (*t. petechialis*), that the value of the remedy is pre-eminent. It was for this affection that Currie so successfully used cold sea-water, at 44° F., of which several gallons were poured over the patient's body. When applied at the onset of the disease, it sometimes arrested the attack abruptly and by a single affusion.

[1] Op. cit., p. 412.

But a day or two, or even a few hours, later, the result was less prompt, and the application had to be renewed. In these cases the heat of the skin was always great, and usually at or above 100° F.; a lower temperature than this was not considered to warrant the employment of cold affusions. The preceding statement is in full accordance with the results of Jackson's experience. "The period," he remarks, "within which a complete and final cure may be expected to be attained with confidence, *is comprehended within the third day*."[1] At a later stage of the attack, this method may, perhaps, palliate the symptoms, and even determine a salutary issue of the disease, but will not much, if at all, abridge it. All experienced writers on this subject coincide in the opinion here expressed. One of the most eminent, Armstrong, uses language almost identical with Jackson's. "During the first, second, and third days of the stage of excitement," he remarks, "more especially during the first, I have sometimes seen the simple typhus entirely extinguished by the affusions of cold water . . . . but from the fourth day of this stage, I have not often seen them useful."[2]

In *typhoid* fever (slow nervous fever, dothinenteritis, typhus abdominalis, enteric fever), cold affusions are of slight advantage, if, indeed, they are not positively injurious. The disease will run a definite course, usually exceeding a fortnight in duration, and cannot be cut short by cold, and probably by no agency whatever. Isolated cases of striking relief to some of the symptoms of the disease, and laborious investigations resulting in the demonstration of how many degrees of temperature the patients lose under the operation of the cold bath, have been published, but nothing whatever which tends to recommend the use of this method as a portion of the ordinary plan of treatment. The cerebral symptoms may indeed be palliated by cold lotions applied to the head, or even by cold affusions upon this part, but the application of cold water to the entire surface of the body ought, perhaps, in every instance to be avoided. The patient may be placed in a warm bath, while cold water is poured upon the head, with great advantage in those cases of the disease which are distinguished by violent delirium, or profound coma, with cool extremities and a collapsed state of the cutaneous surface.

The general success of the method under notice is attested by a great number of physicians, to some of whom reference may be made. Dr. Hall,[3] in an epidemic of petechial typhus, employed cold vinegar and water for washing the body, and found it of great advantage, particularly by rendering the pulse slower and stronger, by abating the delirium and heat of skin, and promoting sleep. During the disastrous wars of the first French empire, typhus fever ravaged Europe, destroying thousands whom the sword had spared, and severely tasking the strength and the feelings of the

[1] An Exposition of the Practice of Affusing Cold Water, etc., p. 183.
[2] Pract. Illustrations of Typhus, etc., Am. ed., p. 65.
[3] Edinb. Med. Com., xx. 327.

officers, civil as well as military. Active measures, therefore, recommended themselves to those who had little hope in any means of arresting the pestilence, and hence the use of cold affusions became general. Reuss and Horn, in Germany, and Mylius, at St. Petersburg, employed them upon a very large scale, and found them of greater service than any other means whatever. Horn, especially, attached great importance to their use, which he combined with the internal administration of cold drinks, with ice to the head, and frequent ablution of the skin.[1] Hildebrandt, too, was disposed, by some trials of his own and by the reports of Currie, to adopt this method of treating typhus.[2] It must be confessed, however, that his authority cannot lend it much weight; for a few years later, and although he had made no trials with it in the interval, he professed his repugnance "to seeing a patient sluiced with cold water as if he were a dog." After a long and extensive experience, Froelich[3] gave a preference to cold affusions over every other mode of treating continued fever; but he limited their application to cases in which the skin was preternaturally hot (above 100° F.). Under this temperature he, like Currie, regarded tepid or cool applications as more salutary than cold, and preferred them to be applied locally rather than generally.

In the "famine fever" which prevailed in Great Britain and Ireland a few years ago, and which was essentially typhus fever, a modification of the treatment by cold water was used with very satisfactory results by Dr. Gill, of Nottingham.[4] Instead of cold affusion, he adopted the wet wrappings of the Græfenberg school. When the skin was burning hot, a sheet wrung out of cold water was applied *closely* to the whole body, which was then enveloped in three or four blankets. Small quantities of cold drink were given from time to time, and the operation lasted from an hour and a half to two hours. The application was followed by a most grateful sense of refreshment, and soon afterwards by a more or less warm perspiration; the muscular pains were relieved, and the delirium and thirst abated. Incipient cases were often cut short by one or two applications of the method. When catarrhal complications or diarrhœa existed, they were improved and not aggravated. In several instances, even, the treatment induced a confined state of the bowels.

It will be observed that between the epidemics of 1812–15 and a very recent period, the treatment of continued fever, of the typhous type, by cold water, appears to have been quite abandoned, nor perhaps would its revival have taken place but for the attention drawn to the subject by the temporary influence of the hydropathic heresy. As Schedel points out, in spite of the general approbation which the method once enjoyed, it soon became reserved for exceptional and urgent cases. When once the epidemic de-

[1] SCHEDEL, Examen. Clinique, etc.
[2] Du Typhus, etc., Trad. de Gasc, 1811, p. 260.
[3] Arch. Gén., iii. 628. [4] RANKING'S Abstract (Am. ed.), vi. 1.

clined which had rendered it popular, the treatment also fell into disuse. Some, like Bateman, did not find it to fulfil the hopes entertained of it, and employed sponging with cold water in its stead. Others relinquished it, and this was perhaps the most common case, on account of the strong aversion to it on the part of the sick, and of the great trouble its employment entailed, so great, indeed, that in private practice it could seldom be resorted to efficiently.

The conclusions which seem to be fairly deducible from the evidence now referred to may be thus summarily stated. Cold affusion forms a powerful, safe, and prompt remedy for typhus fever if applied within two or three days of the onset of the disease, if the patient is vigorous, if the heat of the skin exceeds 100° F., and if no intercurrent inflammation exists. At a later period of the disease, it can act only as a palliative, and is not unattended with danger. At all stages, however, of the augment of typhus, cold sponging of the entire surface of the body tends materially to moderate the febrile action; and throughout the disease cold, in any form, applied to the head, is an indispensable remedy for the delirium and cerebral excitement which belong to this affection.

Eruptive Fevers.—The treatment of exanthematic fevers by cold water is far from being new. Kæmpfer makes mention of it in *measles*, and Bartholini and Theden in *smallpox*. Smith refers to the plentiful use of cold drinks in smallpox as very useful, although in opposition to the received opinions of his day. Sir John Floyer relates several cases of the same disease in which the patients recovered after having thrown themselves into cold water, and Currie several, also, in which its application may have done good. But such instances must be regarded as exceptional, rather than as grounds on which to base a rule of treatment. It does not follow, on the other hand, when the imperfection of the eruption, or the feebleness of the patient, forbids the use of cold water, that the old practice of endeavoring to force a development of the eruption by thick bed-clothing, and by excluding the fresh air, is to be commended. On the contrary, in all of the exanthemata, though in measles with greater circumspection, cool air should be freely admitted, for it goes far, at least, to assuage the irritability of the skin. Hancock, Kæmpfer, and others, indeed, report cases in which cold drinks, and even cold affusions, seem to have been serviceable in measles. Guersent approves of the latter when there is no pulmonary inflammation, and Giannini expresses a similar opinion. The method can seldom, however, be appropriate in a disease comparatively of such feeble action as measles, and in which the pulmonary complication usually contraindicates it. The only form in which cold would seem to be allowable is that of the wet sheet thoroughly wrung out and covered, immediately after its application, with blankets.

But it is in *scarlatina*, a fever in which the skin grows hotter than in any other whatever, that the benefits of cold air not only,

but of cold water applied by sponging, affusion, and even the douche, are so striking as to merit a more particular description. For this method of treatment medicine is indebted to Currie, who published his first account of it in 1797. He was then of opinion that the affusion of cold water "extinguishes incipient scarlatina," preventing the eruption and curing the patient radically. He also recommended the affusions to be made early in the disease, and if at a later period, then only if the skin was dry and the heat greater than natural. He considered cold affusions to be especially applicable to the forming stage of the more sthenic forms of the malady, when the heat of the skin is intense (105° to 112° F.), and attended by great sensibility and a bright red flushing over the whole body, with some stiffness of the neck, hoarseness of the voice, and rawness of the throat. When called in at this early period, his plan was "to strip the patient and dash four or five gallons of the coldest water to be procured over his naked body. . . . In one or two hours afterwards the heat is often found, on examination, as great as before. The affusion is therefore repeated again and again, as the obstinacy of the heat may indicate. . . . At the end of this time, but commonly earlier, the force of the fever is broken, and a few tepid affusions, at longer intervals, are sufficient to subdue it entirely. . . . . On the third day, very generally, or sometimes the fourth, the patient is convalescent."[1] After the third or fourth day, Currie did not use cold, but only tepid, affusions. It must be borne in mind, also, that he did not recommend, but, on the contrary, condemned, this treatment, except when the febrile reaction was free and strong. Indeed, he speaks of certain patients over whom "several gallons of cold water were madly poured" when they were laboring under low delirium, with a cold moist skin and a scarcely perceptible pulse.

Several writers confirm the statements of Currie to a greater or less extent by the results of their own experience. Among them, Richter mentions that he used it with success after the failure of the ordinary method which had previously been curative in his hands. Henke regards the use of cold affusions as applicable to cases in which intense heat of skin and dryness exist along with a small and frequent pulse, and to those in which cerebral symptoms are prominent at the outset of the disease.[2] Cold affusions, and the cold-bath, were also successfully used by Gérard, Bruére, Giannini, and others, in the more violent forms of scarlatina. No one has given more authority to the use of this method than Armstrong, in whose hands it was very successful. His mode of employing it was adopted from Currie, and he declares that he has "in several cases seen the disorder completely arrested by five or six repetitions of the cold affusions used on the first day and night of the excitive stage."[3] This statement refers both to the anginose and the malignant forms of scarlatina. More recently Dr. Laycock, of Edin-

[1] Med. Reports, etc., 3d ed., ii. 47.
[2] RILLIET and BARTHEZ, Mal. des Enfants, ii. 653.
[3] On Fevers, Am. ed., p. 387.

burgh, has employed cold affusions and the wet sheet with marked advantage in this disease.[1] Upon the whole, however, a less energetic use of cold has been found to suffice in the sthenic forms of the disease. Dr. Jackson, then of Northumberland, Pa., first called attention to the advantages resulting from the use of iced drinks, and of pieces of ice held constantly in the mouth. The latter he confined in a gauze bag when the patients were too young to avoid swallowing them.[2] He directed the remedy to be used almost without intermission until the local swelling and the heat of skin began to decline. A more energetic plan than this, and safer than that of Currie, is the one successfully employed by Dr. Hiram Corson, of Conshohocken, Pa.,[3] who, in addition to the means recommended by Dr. Jackson, applied ice to the sides of the neck opposite the swollen tonsils, in some instances, and in others, surrounded the throat with cloths kept wet with ice water. At the same time, he used the latter in affusions upon the head, and as a lotion to the whole body. In this manner, cases of extreme severity were cured. More recently Dr. Corson has reiterated his original statement of the great efficacy of this method of treating the anginose symptoms of scarlatina.[4] He also applied the same method successfully to the treatment of *diphtheria*. It may be described in his own words, as follows: "A piece of muslin, twice folded so as to be just long enough to extend from the lower part of one ear, under the jaw, to the bottom of the other, was well soaked with ice-water, and then applied to the throat, by means of strips sewed to the ends, and then tied on the top of the head. Pieces of ice were then slipped between the folds of the muslin, and were kept constantly applied, night and day. A woollen cloth or a piece of flannel, laid upon the breast, absorbed the dropping water. In a short time after this application the part was as cold as marble; no heat, no redness. The two layers of muslin which intervened between the ice and the neck or jaw, were sufficient to prevent the ice from being uncomfortable."[5] Ice or cold water was also given internally. This method is represented as affording the greatest possible relief, and as more efficient than any other in curing the disease. It was applied with equal success by Dr. W. B. Morris, of Charlestown, Mass., who has reported seven cases which were cured by its means.[6] Several French physicians who have employed this method give an equally favorable account of its utility in cases of diphtheria in which the larynx is not invaded.[7] The hydropathic authorities blame the practice as dangerous, particularly when the fever is high, unless the wet sheet is applied at the same time. They employ the so-called "stimulating compresses" to the throat, renewing them as often as they become dry, and giving iced water constantly to drink.[8]

[1] Times and Gazette, July, 1862, p. 58.
[2] Am. Journ. of Med. Sci., xii. 261 and 550; and ibid., xxii. 45.
[3] J. F. MEIGS, Diseases of Children, p. 480.
[4] Trans. Med. Society of Penna., 1864, p. 451. [5] Ibid.
[6] Boston Med. and Surg. Journ., March, 1864, p. 141.
[7] Bull. de Thérap., lxxviii. 525. [8] SCHEDEL, op. cit., p. 170.

Periodical Fevers.—Cold has been applied in these affections in three different modes: 1st. To prevent the paroxysm; 2d. To arrest the paroxysm in its hot stage; and 3d. To fortify the system against a relapse. Currie, Giannini, Beaupré, and Bailly used it before the rise of the modern water cure, and of these authors the second attributed to its use a prompt and powerful effect in arresting the paroxysm. Beaupré, in like manner, treated with immediate relief, and ultimate success, cases which already wore, or which threatened to assume, a malignant type, cases in which the fever was violent, the countenance injected, the respiration laborious, and the mind either morbidly excited and confused, or dull. A cold bath, lasting about ten minutes, put an end to the paroxysm. The same means were resorted to anew on the return of the subsequent paroxysms, and bark was exhibited in the intervals between them. The results of the so-called "water cure" in these diseases are far from encouraging. The frictions with cold water during the chill, the packing during the hot stage followed by renewed frictions and ablutions, with variations of these measures during the apyrexia or remission, seem to have had a far less decidedly curative effect than various medicinal plans, to say nothing of the specific treatment by quinine or arsenic. But simple cold affusions, in anticipation of the paroxysm, as recommended by Currie, have more evidence in their favor. In a paper presented to the Parisian Academy of Sciences in 1848,[1] M. Fleury furnished the results of his use of the douche in various forms of intermittent fever. All of the recent cases, seven in number, were permanently cured by, at most, four applications of the remedy. Four patients had been affected with the disease between two and eleven months, and had used quinine ineffectually. In two of the cases a cure resulted after three baths, in another case, after five, and in a fourth case as many as forty-eight were required. It is made evident by the preceding facts that the cold bath and cold affusion are valuable remedies in intermittent fever; the paroxysms are moderated or abridged by the former, and prevented by the latter. Affusion, particularly, is deserving of trial in those cases of obstinate intermittent fever which resist antiperiodic remedies, and also whenever quinine of good quality cannot be procured. It is even more important in the treatment of the algid form of malignant periodical fevers, and in that case must be applied during the cold stage. Of all the means which can be resorted to for securing reaction in this dangerous malady, none is so efficient as cold affusion.

Cold drinks in fever ought to be cautiously used in the cold stage,[2] however urgent the thirst, because, in excessive quantities, they increase the coldness, oppress the stomach, and weaken the pulse. When the hot stage is fairly formed, and the surface is dry and burning, cold water may be drunk with the utmost freedom. Jackson advises[3] that in attempting to cure intermittent fever by

[1] Archives Gén., 4ème sér., xvi. 289.
[2] CURRIE, i. 92.
[3] Op. cit., p. 371.

cold water, and provided that the attack is decidedly sthenic in its type, drinks should be refused until the thirst becomes "outrageous," and then given abundantly, so as to extinguish the fever with a single stroke. When this measure is salutary, sensible perspiration and sleep commonly follow. As soon as the skin becomes moist, and the pulse falls, the cold drinks should be suspended. Otherwise a chill, followed by visceral inflammation, will probably be produced.

Congestion and Inflammation.—Nothing allays the painful excitement which accompanies or follows intense application of the mind more readily than washing the head with cold water. Certain persons addicted to prolonged and severe study have sustained their mental activity by keeping a wet cloth bound upon the forehead. The local use of cold water is an essential part of the treatment in all diseases of which headache, delirium, etc., are prominent symptoms. Indeed, it often seems to contribute more than any other remedy to their favorable issue. The sedative impression, to be effectual, must be uninterrupted; if suspended even for a short period, reaction follows, and the symptoms it was intended to subdue become more violent than ever. This is most strikingly the case in local inflammations. A superficial burn, for example, if kept under the influence of cold for a short time only, will be rather aggravated than improved, but if the contact of the remedy is longer maintained, it will effectually prevent the development of inflammation. To obviate this difficulty, Dr. Arnott has proposed the use of a hollow cushion, made of impermeable materials, through which a stream of water at any required temperature can be kept flowing;[1] and M. Chassaignac has stated that for several years he employed what may be called ice poultices to the eye, in cases of idiopathic and traumatic inflammation of this organ. They consisted of pounded ice inclosed in a piece of fresh pig's intestine, and were applied directly to the integument or over adhesive plaster.[2]

Cold drinks, as every one knows, afford great alleviation to the heat and thirst experienced during warm weather, particularly when they contain a vegetable acid. They are not less agreeable and useful palliatives of the morbid heat which is created by febrile affections, including the phlegmasiæ. Nothing is so grateful, or so promptly arrests vomiting in *gastric inflammation.* On the other hand, debility of the stomach is sensibly lessened by drinking a glass of cold water before meals.

Cold has been used in treating *erysipelas*, but examples are not wanting of serious symptoms, such as delirium and coma, and even death, following its application in the idiopathic form of this disease. A mode of applying cold in erysipelas has been proposed by Dr. Arnott,[3] which is certainly a bold suggestion, and, were it not sustained by actual experiment, is not of a nature to invite imita-

[1] Lond. Med. Gaz., Jan. 8, 1846. [2] Abeille Méd., x. 63.
[3] Lancet, 1841–2, ii. 439.

tion. It consists in applying to the inflamed surface, by means of a flat sponge, or a thin gauze bag, a mixture of pounded ice and salt for about ten minutes, until the skin becomes white and hard. According to the cases reported, the inflammation does not return in the parts that have been congealed. Dr. Arnott assures us that the remedy is not only certain and speedy in its operation, but also agreeable and safe. In no instance out of hundreds in which it was employed for various purposes, did it produce any injury or untoward consequences.[1] It is incorrect to say, with Dr. Arnott, and Dr. Watson, whom he quotes, that there is no such hazard as we read of, that erysipelatous inflammation may be repelled from the surface and attack some vital organ. If examples of this accident are not numerous, they exist, nevertheless, and ought to serve as a warning against so extreme a measure as Dr. Arnott recommends. Tepid affusions and emollient applications are not only more grateful to the patient, but also more useful, and at the same time safer. In traumatic erysipelas, however, fluids may be applied at a lower temperature with less risk of harm, because the disease is more strictly local.

Other accidental inflammations, such, for instance, as are occasioned by friction of the clothing, or of the thighs or buttocks, in walking, by the bites of the *urtica marina*, or sea nettle, a gelatinous animal that abounds on the beach at our bathing places, are satisfactorily treated by cold water. Dioscorides recommends it in excoriations, and for bites of venomous insects and reptiles. Non-febrile *diseases of the skin* are less usefully affected by cold than by warm applications, which, indeed, in the form of baths, form an essential part of their treatment. In several establishments devoted to the methodical treatment of skin diseases, cold water has been put to the trial, but the results are not such as to encourage a renewal of the experiment.

The general sentiment of the profession is adverse to the use of cold applications to the trunk in the treatment of its internal inflammations, except when the vigor of the patient is unusually great. Perhaps the sentiment is more in the nature of a prejudice than a conviction. But cold drinks and cold enemata are of the greatest service in sthenic inflammation of the *stomach* or *bowels*. In thoracic inflammations, warm and tepid drinks are to be preferred.

Rheumatism and even *gout* have been treated by cold water from time immemorial, and in every age some writers may be found to favor the method. Hippocrates, Galen, and Celsus speak of cold affusions as relieving the pain and reducing the swelling of inflamed joints. Barthez, while confirming this statement in regard to gout, cautions against the use of too cold a liquid, especially before the affection becomes thoroughly localized. This danger apart, however, he regards the means as tending powerfully to promote diaphoresis, and in that way to dissipate the disease. Compresses

[1] Vid. infra.

thoroughly wrung out of cold water and covered with dry cloths, form the principal means employed for these disorders by the modern hydropathists. Such applications, it will be observed, become warm so rapidly, that the patient is but little, if at all, exposed to the danger of displacing the gouty inflammation. Of all the local means employed, it is the most efficient in alleviating the pangs of this severe disease. It need not of course exclude the use of internal remedies, and particularly of colchicum. In *rheumatism* the same mode of treatment is frequently of signal service. By the partisans of hydropathy, frictions with cold water, followed by sweating in the wet sheet, are recommended as sovereign and certain cures. This assertion may be true as regards general rheumatic fever of slight severity, but is incorrect if applied to severe articular rheumatism. For this disease, the treatment by cold water offers no more advantages, but many more inconveniences and dangers than the other recognized methods. When acute rheumatism is confined to certain joints, the use of wet compresses, as just now described, presents a more certain and less annoying mode of local treatment than perhaps any other. In the decline of the disease, or when it has become chronic, the cold douche, followed by the wet compresses, will seldom fail to remove the pain, swellings, and stiffness, particularly if frictions and a moderate degree of active or passive motion of the part be conjoined.

Scrofula.—Cold bathing, and especially sea-bathing, has always been regarded as a powerful means of counteracting the development of scrofulous swellings, inflammations, and ulcers, and of healing the latter. The local application of cold compresses has more recently been employed for the same purpose. Combined with appropriate exercise and diet, the stimulant and curative effects of cold in these disorders is incontestable. They were among the most striking advantages of the ancient system of hydriatry, and that they still have a claim to confidence is shown by abundant examples of their curative effects. There is no evidence, however, that the peculiar appliances of the Silesian system are more effectual than such as have been established by long experience. Cullen observes that cold bathing seems to have been of more benefit than any other remedy he had occasion to see employed.[1] White recommends it, in common with many other writers, as one of the best prophylactics against scrofula; Russell ranks cold sea-bathing among the first of remedies for this disease;[2] Phillips shows that the temporary benefits of sea-water are at least decided, although he questions its curative power. Lebert accords to the forced sweats, etc., of the hydropathic system, an incontestable value,[3] and Schedel regards these measures as powerful and useful adjuvants to a well-regulated dietetic and medicinal plan.[4]

Hemorrhage.—Cold is variously employed to arrest hemorrhages. A familiar example is its application to the nape of the neck, or to

[1] Works, ii. 637.
[2] COOPER's Surg. Dict., Art. Scrofula.
[3] Maladies Scrofuleuses, 104.
[4] Op. cit., 513.

the surface of the nose to relieve *epistaxis*. Care should be taken not to disengage the coagulum which forms in the nostrils under these circumstances. The writer has seen epistaxis that had continued so long as to become serious, arrested by the application of pounded ice to the outside of the nose. It is said to produce the same effect when applied upon the testicles. When *hæmoptysis* is so profuse as to exhaust the patient, or more immediately to endanger life, it may often be arrested by the use of cold alone. Weak lemonade, mixed with pounded ice, should be sipped continually, bags containing ice should be moved slowly over the front of the chest, while the air of the apartment is kept as cool as possible. Precisely similar means may be used in *hæmatemesis*, except that the pounded ice should be applied to the pit of the stomach. In *menorrhagia* the vulva is an appropriate place for the application, and during the inter-menstrual periods, cold hip-baths and the cold douche may be employed every day. Cold is no less effectual as a means of arresting hemorrhage *after parturition*, or abortion. Compresses dipped in iced water may be applied over the hypogastric region, the vulva, and the upper part of the thighs, cold drinks should be administered, and cold water or even ice introduced into the vagina and rectum. When, owing to uterine inertia, the placenta fails to be discharged, its expulsion may be provoked by injecting cold water into the umbilical arteries. A still more efficient method, is that recommended by Dr. Septimus Wray, and which consists in throwing cold water into the cavity of the uterus.[1] The expedient has the double advantage of evacuating the clots contained in the uterus, and powerfully stimulating it to contract. The introduction of lumps of ice, as large as a pigeon's egg, into the uterus, is probably more successful than any other method of employing cold for the purpose referred to. The benefit to be derived from cold in arresting hemorrhage, before and during labor, is less decided because it generally depends upon causes over which this agent has but a slight control. When, however, the loss is slight, and the uterus is quiescent, cold may contribute to put an end to the discharge. Cold is not without its use even in *traumatic* hemorrhage, particularly from small vessels, or when there is a simple exudation of blood from the injured surface; but for this purpose it must be continuously applied so as to prevent reaction and a consequent increase of the discharge.

Chlorosis and Anæmia.—These allied but not identical affections are, it is well known, more or less medicable by ferruginous preparations, but their cure is both hastened and confirmed by the judicious employment of cold. The cold douche is here the most efficient means. It was used with perfect success by M. Fleury,[2] and to the exclusion of all internal medicines in five cases of confirmed chlorosis. The treatment lasted from two to seven months, and the douche was administered two or three times a day, and for

[1] Lancet, April, 1855, p. 361.
[2] Archiv. Gén., 4ème sér., xxv. 180.

as many minutes at each time. The shock at first produced difficulty of breathing, and violent palpitation of the heart, but after the third or fourth day these phenomena ceased. The appetite and strength soon increased, the stools grew regular, and the neuralgic symptoms disappeared. Afterwards the skin grew ruddy and clear, the menses were re-established, and became both more abundant and less painful. Idiopathic anæmia, and that which is symptomatic of convalescence from tedious diseases, of certain uterine affections, of neuralgia of long standing, of hypertrophy of the liver or spleen, of miasmatic cachexia, chronic inflammation of the digestive organs, profuse and repeated hemorrhage, etc., were found by M. Fleury to be thoroughly curable by cold affusions. When the anemic condition depended on an organic yet removable cause, on the one hand, or upon incurable disease upon the other, the strength of the patient was still materially improved. In the former case the cure of the principal disease was rendered more practicable, and in the latter the general health and comfort were in many instances promoted.

Diseases of the Nervous System.—An affection very nearly allied to the one just noticed has been described by various authors as susceptible of cure by the same means. It is one of *nervous exhaustion*, a state which seems to be almost the normal condition of certain delicate individuals, but which may also proceed from prolonged fatigue, wasting discharges, undue exertion of the mental faculties, etc. This condition is very certainly relieved by a judicious use of cold water. But very often the patient is too feeble to react under even a trifling and partial application of cold. When the constitution, says Beaupré,[1] "is extremely delicate and susceptible, the skin cold and pale, or of a dusky leaden hue, when the eyes are dull, the flesh soft, flabby, or œdematous, the perspiration viscous and cold, the pulse small and feeble, and there is a frequent sense of chilliness," the free use of cold applications in any form will be attended with danger, and certainly produce no good. In such states as are here referred to, the use of the cold bath should be approached very gradually, and means vigorously employed promptly to restore the circulation to its full activity. By such a method the dangers referred to may be averted, and the full tonic power of cold, with all its advantages, employed. There is an original state of the constitution the general features of which are closely analogous to those of the acquired condition just described, and which has a strong tendency to favor the development of organic diseases, and especially those of a lymphatic nature. It is a state of general debility, as shown by muscular weakness, a pale, transparent, and flabby skin, a languid circulation, and a morbidly susceptible nervous system. It is most distinct in children, and, unless early checked and modified, leads, as has been stated, to serious and even fatal disease. Cold bathing, and especially the cold douche, is the most efficient auxiliary in renovating this con-

[1] Op. cit., p. 216.

stitution, and bringing it gradually into a condition less susceptible to morbid impressions; but this means must be united with active exercise, wholesome nourishment, and the withdrawal of all merely nervous stimulants.

Cold is one of the most efficient remedies for cerebral excitement, such as occurs in febrile diseases generally, as well as for positive *inflammation of the brain*, or its membranes. Pounded ice, or what is preferable, iced water, and artificial refrigerant lotions, constitute, perhaps, the most effectual palliative of the last-named disease, as well as for reducing cerebral excitement of a symptomatic character. Abercrombie calls it by far the most powerful of local remedies in cerebral inflammation, and mentions the cold douche as the most efficient form in which it can be employed. Indeed, when a stream of cold water is directed against the crown of the head, and continued for some time, it forms a remedy of such energy as to require to be used with much caution.[1] Two apparently opposite conditions exist, in both of which this remedy is indicated; the one in which there is maniacal excitement, the other where the functions of the brain appear to be oppressed. The former is that to which Abercrombie has especial reference, and which belongs to the early and active stage of what he regarded as cerebral inflammation. When this had passed, or when, without its having existed, an effusion within the cranium is indicated by the tendency to coma, dilated pupils, and an infrequent and slow pulse, cold affusion on the head may produce the happiest results. But the water must be of low temperature (about 36° F.), must fall from a height of two or more feet, and its application must be renewed at intervals of three or four hours. If perspiration breaks out, the affusion should be suspended. Probably more hopeless cases of such affections have been cured by its means than by any other. The immediate effect being to restore some degree of consciousness, it is probably also accompanied with a renewed power of assuming a more healthy action by virtue of the innate powers of the system, or through the operation of other remedies, both internal and external. It is a remedy which should never be omitted from the treatment of any case, the symptoms of which denote pressure upon the brain. In some affections supposed to be cases of acute meningitis, it has saved life when all hope was lost.[2] It would be extravagant, however, to expect from this remedy, powerful as it is, any substantial benefits when plastic effusion to any considerable extent exists, and especially in the only form which exists of idiopathic acute meningitis, the epidemic, in which the lesions abound at the base rather than upon the convexity of the brain. A cautious trial of it in doubtful cases will generally afford grounds for continuing its use or for relinquishing it.

Sunstroke.—Although the use of cold water applied in lotion or douche to the head has been generally employed as a remedy for

[1] Diseases of the Brain and Spinal Cord, Am. ed., p. 174.
[2] See SCHUTZENBERGER, Abeille Méd., xii. 238.

insolation, and with excellent results, it does not seem to have occurred to any one before Dr. B. Darrach, while a resident physician of the New York Hospital, to make use of cold applications to the general surface of the body in this fatal affection. He was led to their use by observing the intense heat of the skin, which is between 109° and 111° F. Several cases in which active friction of the skin was made from head to foot with pieces of ice, while brandy was administered internally, appear to demonstrate the efficacy of this method.[1] Of seven cases treated at the Pennsylvania Hospital in the same manner, by Dr. Levick, six recovered.[2] The experimental researches of Dr. H. C. Wood, Jr., led him to the conclusion that the phenomena of sunstroke ("thermic fever") are due to the coagulation of myosin in the body by intense heat, and he, therefore, deduces from this fact the appropriateness of the treatment by cold.[3] But the appropriateness of the treatment stands in no necessary relation to the theory. The former has long been established clinically to be one of the best methods of treating sunstroke; but the correctness or the incorrectness of the proposed theory of the disease is a question entirely independent of the value of this or of any other mode of treating it.

Insanity.—The paroxysms of furious delirium which frequently attend insanity are more effectually moderated by the cold douche than by any other means whatever, and when the disease is acute, this treatment often brings about a perfect cure. Its efficacy is greatly increased by being administered while the patient is in a warm bath. In the intervals between the baths cold compresses may be applied as often as possible to the bare scalp. The method employed by M. Brierre de Boismont was so successful as to merit particular notice. The patients remained from eight or ten to fifteen hours in covered baths at from 82° to 86° F., while a current of cool water flowed continually over their heads. The temperature of the affusions was from 40° to 60° at the commencement of the bath, and at its conclusion from 64° to 68° F. The following are among the inferences drawn from his experience by M. Brierre: 1. Acute insanity, and especially acute mania, may be cured in from two to four weeks by this method. 2. The essentially calming and sedative action of these baths is demonstrated by their influence on the circulation and the respiration, the absorption of a large quantity of water into the system, and the gradual and general cooling which they produce. 3. The duration of the baths should, in general, be from ten to twelve hours; they may be prolonged to fifteen or eighteen hours. 4. This treatment may improve, but does not cure, chronic mania.[4]

As the shower-bath and the douche are both of them repugnant to almost all patients, they become powerful means of moral treatment in the hands of a judicious physician, if they are prescribed,

[1] Am. Journ. of Med. Sci., Jan. 1859, p. 55.
[2] Ibid., Oct. 1866, p. 573.
[3] Thermic Fever (Boylston Prize Essay), 1872.
[4] Journ. of Psychological Medicine, i. 456.

not as punishments, but with the distinct announcement that they have the power of removing the delusion, hallucination, or state of mind which causes the patient to act contrary to the settled laws of truth.[1] To use them for punishment is to degrade a wholesome and kindly discipline into an instrument of torture. The cold bath and the douche are also very efficient remedies for the sleeplessness which is so common in the active forms of insanity.

Delirium Tremens.—Cold affusions on the head have been recommended by many authorities for this disease, particularly if the body of the patient is at the same time immersed in a warm bath.[2] Armstrong used them with greater boldness. When the patient was robust and in the first stage of the attack, he caused several gallons of cold salt water to be dashed over his body.[3] But he confined its use to patients who had much constitutional vigor, and both before and after its application gave them warm wine and water to drink, and followed the douche by active frictions of the skin with warm flannels. Without doubt there are instances of the more violent and maniacal form of the disease (*mania-à-potu*) occurring in robust patients, which have been wisely and safely treated by this heroic method; but it cannot be generally applicable even to the more violent cases. That the tepid bath with cold affusions to the head is safer and more effectual cannot, it is believed, be doubted. Old and broken-down drunkards cannot bear the sedation even of this mode of applying cold, and, indeed, in any form it should rather be avoided in treating them.

In *poisoning by narcotics* there is no remedy more important than cold affusions. Applied to the head, they may be repeated frequently, but they cannot be so often renewed to the rest of the body; for, although the shock which they cause is of the highest utility in arousing the torpid functions, yet their frequent repetition lowers the temperature of the body too much, and rather hastens than impedes the progress of coma. Two cases of poisoning by opium, and one by belladonna, are reported by Dr. A. R. Jackson, in all of which the prompt and salutary influence of cold water poured upon the head is illustrated. No other remedy contributed to remove the profound narcotism.[4] Dr. Monroe has also published a case of opium poisoning successfully treated by pouring a thin stream of cold water upon the epigastrium from a height of eight or nine feet. In this case the impression was made through the sense of pain excited in one of the most sensitive portions of the skin.[5]

Chorea.—Many years ago, Dupuytren drew attention to the value of cold affusions in this disease.[6] He directed the patient to be plunged into a cold bath and rapidly withdrawn as often as five or

[1] Comp. LEURET, Traitement Moral de la Folie, p. 156.
[2] BLAKE, Pract. Essay on Delirium Tremens, p. 88.
[3] Pract. Illustrations, ed. cit., p. 568.
[4] Am. Journ. of Med. Sci., July, 1866, p. 74.
[5] Boston Med. and Surg. Journ., May, 1866, p. 354.
[6] Archives Gén., xxiv. 130.

six times in the course of a quarter of an hour; or sometimes he preferred simple affusions of cold water, after which the patient was made to take active exercise for a few minutes, and was then covered up warmly in bed. Dupuytren maintained the infallibility of this method, and cases of its success are reported by Hospital.[1] Biett gave a preference to the shower-bath, and asserted that he had cured severe cases of chorea in eight or ten days by the use of this means exclusively.[2] Constant[3] found cold baths (65°), continued for an hour at a time, with the use in some cases of cold affusions to the head, very successful in the same disease. Rilliet and Barthez do not furnish as favorable an account of the results obtained by them from the cold bath.[4]

There can, however, be no doubt of its efficacy; almost every practitioner can testify in its favor; but it must nevertheless be used circumspectly, and so as not to excite either dread or alarm. Hence it is a measure but seldom applicable to very feeble and excitable children, and is rarely proper in the winter season. Apart from these and similar exceptions, cold baths, and particularly cold affusions and the shower-bath, are among the most valuable means of treating chorea. They are sometimes curative even when used alone, but they are much more generally to be recommended as adjuvants to internal remedies.

We have seen a very prolonged and distressing case of *hiccup* in an adult male, and which had resisted all other remedies, immediately and permanently cured by swallowing, at short intervals, small fragments of ice.

Hysteria.—Cold has no special application in this disease beyond that of diminishing the congestion of the head which sometimes exists during the paroxysms, but it may become a valuable addition to the other means employed in the intervals of the attack for the purpose of preventing local determinations of blood, and of reducing the morbid susceptibility of the system. When attacks of hysteria simulate death, as they occasionally do, the sudden application of cold to the surface of the body will revive the signs of life. Closely allied to hysteria is the melancholy disease *nymphomania*, for which no remedy is more effective than the prolonged use of cold baths, and particularly of the hip-bath. It must, of course, be conjoined with various appropriate remedies, both moral and physical.

Puerperal Convulsions.—In cases of this affection, with evident signs of cerebral congestion, ice to the head and nape of the neck, and the cold douche upon the head, should not be neglected. The latter constitute one of the most powerful means of assuaging and ultimately arresting this dangerous accident of the puerperal state.

The usefulness of ice applied to the spine as a means of treating *epilepsy* has been illustrated by Dr. John Chapman,[5] but we cannot

[1] Bull. de Thérap., vi. 206.
[2] Ibid., vi. 300.
[3] Ibid., viii. 333.
[4] Mal. des. Enf., ii. 319.
[5] Times and Gaz., July, 1863, p. 60; ibid., March, July, and Sept. 1865.

learn that it has been followed by very unequivocal benefits in the practice of this physician, or that others have reported favorably concerning it.

Sleeplessness, which often depends upon an over-excited condition of the brain or of the whole nervous system, arising from severe study, from the stimulus of painful and even of pleasant thoughts or occupations, is often relieved by the use of cold affusions or simply of the cold bath. On the other hand, as already stated, persons addicted to intense mental application have been enabled to maintain it for a longer time than usual by keeping cloths wet with cold water to the forehead, thus illustrating the general truth that the action even of the simplest remedy varies with the state of the organism when it is applied.

Tetanus.—A case of traumatic tetanus was reported by Dr. Curry, of London, which he claims to have been cured by affusions of cold water, two pailfuls of which, at 62° F., were thrown over the patient every four hours during twelve successive days. It is proper to state, however, that laudanum was freely administered at the same time. Dr. Currie, of Liverpool, on the other hand, mentions several instances in which cold affusions did not benefit the disease at all. Indeed, the inference may justly be made from the records relating to this subject, that in traumatic tetanus cold affusions are of little or no advantage. Abundant evidence, on the other hand, exists to prove that this remedy is of the utmost service in the idiopathic form of the disease referred to, particularly when it occurs in warm climates. This result of modern experience tallies with ancient observation as recorded by Hippocrates.[1] In a paper on the use of cold bathing for the cure of idiopathic tetanus in the West Indies,[2] allusion is made by its author, Mr. Cochrane, to a Dutch practitioner, who, about the year 1725, employed a method suggested no doubt by the writings of Floyer. "He carried it so far," says the narrator, "*as to lay the patient in wet sheets*, by which means he cured one patient. But as the practice was new, and not having the consent of the proprietors, he could not take upon him to try this method, however desirous he might be, well knowing the risk a man runs in going out of the old beaten track." In 1791 Dr. Tallman, of N. Jersey, cured a case of idiopathic tetanus with cold affusions;[3] and Dr. Prioleau, of S. C., in 1812, published several analogous examples of success.[4] The remark made above touching the inefficacy of this method in traumatic tetanus must be modified so far as relates to the more powerful mode of applying cold by means of ice. Dr. B. D. Carpenter states that he cured fifteen out of sixteen cases of this affection by means of ice contained in bladders and kept steadily applied to the spine.[5] The same mode of using the remedy has also been reported to be successful in a case of traumatic tetanus,

[1] Aphorisms, v. 21.
[2] Edinb. Med. and Phil. Com., iii. 183.
[3] Tr. of Coll. Phys. Phil., i. 205.
[4] Am. Med. and Phil. Reg., iii. 8.
[5] N. Y. Journ. of Med., Jan. 1860, p. 133.

by Mr. Adams;[1] in one of idiopathic tetanus, by Mr. Howard;[2] and in a very interesting and singular case, reported by Dr. Edmunds, of emprosthotonos occurring in a nursing mother.[3] *Paralysis* of the lower limbs, apparently functional in its nature, has been cured by the application of ice to the spine.[4] *Lead colic* has been very successfully treated by Monneret, with cold within and without, cold water in copious draughts, the cold douche, and still more by the ice poultice, *i. e.*, a mixture of pounded ice and bran, applied between cloths to the abdomen. Dr. Monneret refers to thirty-eight cases in which a cure was wrought by this method alone.[5]

The spasmodic symptoms, attended with high arterial excitement produced by drinking very cold water or alcoholic mixtures, in hot weather, are speedily relieved by cold affusions to the head, and cold drinks.[6] (Vid. *Sunstroke*, ante, p. 224.)

Diseases of the Digestive Organs. Constipation.—The ancient practice of promoting alvine evacuations by applying cold to the feet, is illustrated by the following case of Hippocrates.[7] A stout, healthy woman, who had taken some emmenagogue medicine, was seized with a violent pain in the abdomen, which grew much distended; she vomited blood, and became to all appearance lifeless. About thirty vessels of water were dashed over her, which procured free bilious evacuations, and the patient recovered. A certain Duke of Ferrara was subject to constipation, and could obtain relief only by walking upon the marble pavement of his chamber when he arose in the morning. Cullen observes that when every purgative has failed in this disorder, the action of the intestines may be effectually excited by throwing cold water on the extremities. An instance of this sort is related by Stevenson.[8] One also is reported by Vaidy,[9] of a patient who for twenty days had suffered from obstinate constipation, which repeated doses of purgative medicine did not relieve. A tumor as large as a man's head could be felt in the hypogastrium. As a last resort, the patient was directed to walk barefoot upon wet flagstones, and compresses wet with iced water were applied to the abdomen. Very soon afterwards an evacuation took place of liquid, and then of solid fæces, and the tumor disappeared. Two very interesting cases of a similar character were reported by Dr. Spence,[10] who caused the patients to stand on a cold, wet, brick floor, while cold water was dashed upon the lower extremities as high as the hips. Still another is related by Falconer,[11] in which a lady who was reduced to the last extremity by the long retention of her fæces, and the active measures employed to relieve her, at last obtained an evacuation

[1] Lancet, July, 1864, p. 67.
[2] Ibid., Oct. 1864, p. 377.
[3] Times and Gaz., March, 1864, p. 280.
[4] Times and Gaz., May, 1864, p. 587.
[5] Gaz. des Hôp., 1867, No. 43.
[6] S. JACKSON, N. A. Med. and Surg. Journ., ii. 250.
[7] Epidem., v. xviii.
[8] Edinb. Ess. and Obs., vi. 536, 568.
[9] Dict. en 60 vol., xviii. 414.
[10] Trans. Lond. Coll. Phys., iii. 96.
[11] Mem. Lond. Med. Soc., ii. 73.

under the influence of cold affusions upon her hands and legs. In 1791, Dr. Bartram, of South Carolina, used the same method, with the addition of swathing the abdomen "in cloth dripping wet with cold water," in a case of obstinate constipation, with abdominal distension and pain, constant vomiting, and a quick, small pulse. All other means having failed, those mentioned were employed with prompt and complete relief.[1] An analogous but still more desperate case, in which the constipation had resisted every internal remedy for fifteen days, was relieved in the same manner by Mr. Kite.[2] Mr. Whitehead[3] relates a case in which a prodigious quantity of purgative medicines and clysters had been used to no purpose. The patient was an old man, and was rapidly sinking. As a last resort, cloths dipped in ice-cold water were suddenly and unexpectedly applied to the abdomen. Immediately its distension began to subside, an evacuation of hard, dry fæces took place, and the patient recovered. A draught of cold water before breakfast is an excellent palliative of habitual constipation.

The advantages of modern hydriatry are more clearly illustrated in the treatment of abdominal affections, and especially of habitual constipation, than of any other diseases. So large a proportion of the chronic diseases of the digestive organs arise from over-eating and sedentary occupations, that the cultivation of simpler and more rational habits of life forms the first step towards their cure; yet it is one which very few patients will consent to take so long as they remain at home. But the discipline and the novel impressions of a sanitary establishment, together with the faith which men are prone to place in what is strange, go very far to bring about cures which had been impossible under the dominion of cherished and long indulged habits of unwholesome living. It is, however, no more than just to observe that the systematic use of bathing, frictions, sweatings, exercise, etc., as enjoined in water-cure establishments, contributes largely to their success in cases really adapted to such discipline. The daily use of the wet sheet followed by a cold bath and active frictions of the whole surface of the body, the cold hip-bath, the constant use of the stimulating compress to the abdomen, occasional cold enemata, frequent and copious draughts of pure cold water, together with a simple diet, of which milk and brown bread form a considerable part, these and active exercise constitute the means by which the most confirmed torpor of the bowels has been overcome in numberless cases in which the entire catalogue of drugs had been unable to effect a permanent and perfect cure. When constipation is connected with disorder of the stomach, with atony, or with excessive irritability of this organ, the means just pointed out, when adapted to the vigor of the patient, are probably more effectual than any others that can be employed. In such cases the failure both of medicinal and merely dietetic remedies is only too familiar to physicians.

[1] Trans. Coll. Phys. of Phil., i. 203.
[2] His Essays and Obs., Lond. 1795.
[3] London Med. Gazette, 1841, i. 58.

Instances are not wanting of habitual vomiting after eating, with obstinate constipation and progressive emaciation, which have been cured by the hydriatric method, after the failure of the best devised medicinal treatment. As a sedative of deranged nervous action, a stimulant to the skin, a revulsive to the digestive organs, and indirectly as a tonic to the whole system, cold acts more powerfully and usefully in these cases, while the stomach is spared the injury of the direct contact of purgative drugs. In the class of cases alluded to, the radical morbid element destroyed or removed by cold is undoubtedly want of tone, and this sometimes is, if not usually, combined with gastric irritability. There are certain examples of *chronic diarrhœa* in which this combination of morbid elements is present, and these may doubtless be materially benefited by the united tonic and revulsive influence of cold water. Where there is reason to believe that the flux depends upon an ulcerated state of the intestine, the employment of the remedy is at least of questionable propriety. It is certainly inferior to many agents of the materia medica. Mr. John Chapman, of London, proposed to cure *epidemic cholera* by applying ice-bags to the spine, upon the ground that cold excites the sympathetic nerve so as to constrict the bloodvessels of the intestines, and arrest the flux of serum from the bowels. It does not appear that experience has fulfilled his scientific prevision. The same gentleman urged the utility of this method in relieving or preventing *sea-sickness;*[1] and in this case claimed the favorable reports of patients who, at his suggestion, applied the remedy. It would not seem to have inspired other persons with the faith in its efficacy which possessed its author, for we are unable to learn that others have put it into practice.

In Surgery.—Contusions, etc. Cold water is at once the simplest and the best application for bruises, or for that general soreness which results from a fall or other direct violence. The first application should be tempered, but the subsequent ones may consist of cool water, followed by frictions to the skin, and the bruised parts should afterwards be covered with wet compresses. After the reduction of dislocations the affected joints should be enveloped in moist compresses, to prevent reaction, effusion, and consequent stiffness. Should, however, this result have already taken place, then the cold douche, followed by frictions, is more likely than any other treatment to restore liberty of motion to the joint. The use of cold affusions, or of wet compresses, is not less serviceable after injuries or fractures in the neighborhood of joints, in order to prevent inflammation. The same may be said of sprains, which, indeed, often involve laceration of the articular ligaments. Bidou, who wrote upon these injuries,[2] maintained that when cold water is opportunely applied, the patient will recover the use of the limb in one-third of the time required by other methods. He recommended that the foot and ankle should be plunged into cold water,

[1] Lancet, March, 1865, p. 232. [2] Bull. de Thérap., i. 243.

and allowed to remain there for two or three hours, the water meanwhile being kept at its original temperature. At the end of this time wet compresses may be substituted for the foot-bath, and continually renewed until the danger of inflammatory reaction is past. Some very interesting cases have been reported by Dr. Tillet, of Lancaster, Pa.,[1] which illustrate the present subject in a striking manner. Among them is one of a physician who suffered fracture of an anchylosed knee. The patient was extremely corpulent, weighing upwards of three hundred pounds, and the leg became violently inflamed. During three weeks cold water was poured upon the knee every five or ten minutes, and subsequently at longer intervals, and the pain and swelling were effectually kept under by its means. So violent were the local symptoms, that no other treatment would probably have saved the limb.

Wounds.—One of the first persons in Great Britain to follow the advice of Macartney relative to water-dressings was MacFadzen,[2] who had observed that in the lower animals inflammation was not necessary to the healing of wounds. He also found that under this method they healed neither through the medium of blood, lymph, or pus, but by a contracting process from the bottom of the wound upward. He applied compresses of lint, wet with cold water, and covered with oiled silk, three times a day. Beaupré, Josse,[3] and others spoke very emphatically in praise of this treatment, and the latter proposed and extensively employed the method of continuous irrigation. It was afterwards adopted by Bérard.[4] He made use of siphons, of small diameter, to conduct the water to the affected part, which was covered with a single thickness of linen, and rested upon a piece of oil-cloth, which conveyed away the water that had been used. The first effects of this method are a lowering of the temperature of the part, and a sensation of coldness, which is generally painful at first; then the skin grows paler, and the swelling subsides; the former subsequently acquires a dull red or even a whitish color, and the superficial layers of the integument swell with the water they have imbibed. Like Macartney, Bérard found that adhesive inflammation is not hindered by cold water; that, on the contrary, even contused wounds sometimes unite by the first intention under its use. He suspected, however, that it tends to increase the chances of mortification after lacerated and contused wounds. This opinion seems to have been entertained by Dupuytren,[5] who also objected to the method as being disagreeable to the patients by causing chilliness, and dangerous by exciting internal inflammations. The apprehension of producing serious inflammations within the cavities of the chest or abdomen by employing cold applications to the trunk seems to be quite groundless. Such applications are familiarly and successfully made, when hemorrhage

[1] N. Am. Med. and Surg. Journ., v. 58.
[2] Edinb. Med. and Surg. Journ., 1830, xxxiii. 84.
[3] Archiv. Gén. de Méd., 2ème sér., viii. 399.
[4] Ibid., vii. 1; and 2ème sér., xiii. 343.
[5] Leçons Orales, ed. de Bruxelles, i. 448.

takes place from the thoracic and abdominal organs, but a less degree of cold suffices for antiphlogistic purposes. Other surgeons, also, as Gerdy and Sanson, were inclined to believe that, although this treatment favored the resolution of superficial inflammation, it nevertheless was sometimes objectionable by concealing deep-seated suppuration of the injured parts.[1] If these objections to cold water dressings are tenable, much more strongly must the plan of M. Baudens be condemned. He did not scruple to use a freezing mixture applied through the medium of a thin layer of lint or sponge upon the injured part; afterwards ice alone was substituted, then cold water, and ultimately dry lint. It may be considered as determined by experience that very low degrees of cold are seldom, if ever, necessary to combat traumatic inflammation. Very often the water dressing should be even tepid, in order to meet the peculiar susceptibility of the patient, and it very seldom happens that it need have a lower temperature than 70° to 80° F. For it must be remembered that not only the temperature, but also the other physical properties of this application are antiphlogistic and healing. It carries away the secretions of the injured part, which, if allowed to remain, would perhaps excoriate the integuments or maintain the inflammation, and by regulating the activity of the latter, it promotes healing by the first intention or by rapid granulation. It is believed that of all the applications of cold water none has been more generally accepted than this; and although the more troublesome methods of irrigation and repeated affusion may be retained for exceptional cases, there is reason to expect that lint wet with cold water, and covered with oiled silk, will, for a time at least, supersede the exclusive use of greasy applications to recent external lesions of the soft parts.

Local Inflammations.—When the treatment of *boils*, *carbuncles*, *whitlows*, etc., by cold applications was revived in England, we are told by Mr. Eames that the patients were so surprised at the rapidity of the cure as to be persuaded that a charm had been used.[2] And no doubt the persevering use of cold water in such local inflammations would in a great majority of instances arrest their development completely. That most painful, and indeed serious, affection—for it may disable the hand upon which a man depends for daily bread—whitlow, may almost always be summarily arrested by holding the finger for several hours in ice-water. Mr. Curling treated several cases of *acute orchitis* successfully by the application of ice. It speedily relieved the pain, and effected an unusually rapid cure.[3] *Ulcers* in various conditions are beneficially treated by water-dressings. One of the earliest allusions to the efficacy of water in these affections was made by Smith,[4] who speaks of an extensive ulcer caused by molten brass running over the leg, and which was finally cured by the patient, who was

[1] Archiv. Gén., 2ème sér., viii. 402.
[2] Edinb. Med. and Surg. Journ., xxx. 84.
[3] Times and Gaz., Feb. 1855, pp. 210, 233.
[4] Curiosities of Common Water, p. 35.

fond of fishing, having stood for several hours at a time in a running stream. As early as 1813 we find Mr. Johnson reporting the remarkable success he had met with in treating indolent ulcers by sea-water only.[1] As generally happens, so in this case, a theoretical objection opposed the general acceptance of the improved treatment. It had grown into an article of faith that cold was hostile to the reparative process, and consequently the evidence which demonstrated its salutary influence was unheeded or disbelieved. But the power of truth ultimately overcame disbelief. Percy and others demonstrated that nothing was more conducive to the healing of indolent and flabby ulcerations than the cold douche, and nothing more likely to counteract the tendency to inflammation and extension of active ulcers than the permanent application of cold water dressings. In those ill-conditioned sores that spread by gangrene, or in consequence of the low vitality of the parts they affect, nothing effects a change for the better so soon as water, applied at a temperature adapted to the sensibility of the patient and of the affected part. Butzke[2] was very successful in curing atonic ulcers of the feet by the cold douche, continued for an hour or more at a time. The first effect of the remedy was severe pain, which made it necessary to render the application very brief; but this was followed by a deep redness of the skin near the ulcer, with some bleeding from its surface, an itching sensation, increased heat and swelling of the part, and a larger discharge of pus, demonstrating the stimulant effects of the remedy. After its application in the manner described, the part was wiped dry, covered with charpie, and bandaged.

Burns and *scalds* have been very successfully treated by cold water. As early as the middle of the last century, Godfrey cured burns by immersing the injured part in cold water for several hours.[3] In 1806, Dr. McDowell, of York, Pa., reported two cases of severe scald of the feet and legs which were treated by immersion in cold water, with the effect of speedily relieving the pain, and causing the skin to heal very quickly;[4] and several years later a case of extensive superficial burn of the hand, to which snow-water and afterwards cold pump-water were applied, almost immediately allaying the pain, and preventing suppuration.[5] In burns of the first and second degrees cold water applied by affusion, irrigation, or simply upon thin cloths, not only relieves the pain, but arrests the inflammatory process and promotes a speedy return of the part to its normal action. But, to be successful, the application must be constantly and steadily made, otherwise reaction annuls all the benefits of the first impression. It ought, moreover, to be employed at the earliest moment possible after the injury is received, while the blood is still mobile in the vessels, and before any effusion has taken place. No other treatment affords such prompt

[1] Edinb. Med. and Surg. Journ., ix. 277.
[2] London Med. Gaz., N. S., 1839, i. 893.
[3] Edinb. Med. Essays, 3d ed., vol. v., Pt. ii., p. 414.
[4] Med. Repos., ix. 366. [5] Ibid., xiv. 286.

relief, or promotes so evidently the direct restoration of the functions of the part. James Earle advocated the use of cold water, and even of pounded ice, applied on cloths or in a bladder; Dr. Kinglake wrote to the same purpose; Emalse, who is quoted by Kentish,[1] relates a singular instance of the efficacy of continued affusions of cold water; Dzondi wrote a treatise to advocate its use[2] as the *only* sure and painless mode of curing these injuries; and Kusten also reports striking instances of its healing power.[3] *Ice* has been very extensively and successfully used for the same purpose by Blandin, Jobert, Baudens, Robert, Hutin, and others.[4] It was generally pounded, and applied in a bladder to the affected part. According to Robert, it should be continued, even when the burn is deep, until the sloughs are thrown off; but such a plan has nothing to recommend it, and much to dissuade from its adoption. One of the authors cited advises that, even when the injury occupies a large surface of the body, the patient should be lifted upon a sheet, and plunged over and over again in a cold bath. This treatment, it is alleged, procures infinite relief from suffering, and greatly restricts the extent of the sloughs which follow. The measure seems, indeed, a bold and dangerous one; but, provided the patient is sufficiently vigorous to sustain the shock, it may doubtless prove salutary. It must abstract a large amount of morbid heat from the body, and, at the same time, by the reaction it induces, invigorate the skin, enable it to resist the tendency to gangrene, and reanimate the powers of life, which are never more depressed than by extensive burns. In well-selected cases, therefore, it is not improbable that the cold plunge-bath may be safely and advantageously employed.

Strangulated Hernia.—By the application of cold to a hernial tumor it is often made reducible. If ice is employed, it should be very carefully managed lest it occasion gangrene. But cold water, or ether, which, by evaporating, produces cold, is sufficient to expel the fluids from the tumor and enable it to be reduced. When it only contains air, the action of cold lessens its volume with singular rapidity. Writers upon this subject draw a just distinction, in reference to the advantage of cold, between strangulations caused by distension and those produced by inflammation. The former are relieved readily and effectually by the brief action of a low degree of cold, but when the protruded parts are attacked with inflammation it is more prudent that the temperature of the application should be moderate and maintained for a longer time, because the tissues to be acted upon are denser and less mobile than in the previous case, and do not, therefore, contract so readily under the action of cold. Still, there are cases in which, although inflammatory symptoms had set in, the free and prolonged application of

[1] Essay on Burns, 1817, p. 38.

[2] Ueber die Verbrennungen, und das einzige sichere Mittel sie in jedem Grade schnell und schmerzlos zu heilen. Halle, 1816.

[3] Am. Journ. of Med. Sci., Oct. 1847, p. 488.

[4] Annales de Thérap., iv. 62.

pounded ice has afforded relief. In one,[1] peritonitis, following the operation for strangulated femoral hernia, was arrested by the persevering use of this remedy. Ice and other means of producing cold were used by Sir Astley Cooper to promote the reduction of hernia; the former has been successfully employed by Mr. Le Gros Clark,[2] and no less than nine cases have been published by M. Baudens to demonstrate its efficacy when conjoined with graduated compression.[3]

Anchylosis.—The stiffness which continues to affect joints after prolonged rest and after idiopathic or traumatic inflammation is more effectually removed by cold affusions than by any other single means. They should be managed so as to stimulate the affected parts, and their use should be combined with frictions and passive motion. Indeed, they serve admirably to prevent the injurious effects which the last-named manœuvre occasions when too vigorously performed.[4] In *hysterical rigidity of the joints* the cold douche has also been successfully employed.

Vascular Distensions.—It has been proposed to cure superficial aneurisms by a constant application of ice. Cases of success in the early stage of the affection are recorded by Guérin, Pelletan, and Böe. The palliative use of this remedy in dilatation of the hæmorrhoidal veins is well known, and Chrestien reports a case in which the application of cold to the penis enabled him to introduce a catheter, the entrance of which had been prevented by a varicose condition of the veins of the urethra.[5] Repeated irrigations of cold water are sometimes of immense advantage in reducing the engorged and ulcerated neck of the *uterus* to a normal condition, and thus indirectly of curing its displacements.[6] M. Aran attributes great advantages to this method, to which, also, he adds the introduction of pieces of ice into the vagina by means of the speculum.[7]

Cold as an Anæsthetic.—Two hundred years ago Bartholini, in his celebrated Essay (*De Nivis Usu Medico*), directed the application of snow to ulcers about to be cauterized, and referred to its use in deadening the pain of incisions through the skin. Beaupré relates that a soldier whose leg had been amputated suffered excruciating pain in the stump, which neither opiates nor any other means relieved, until compresses wet with cold water were applied, when the pain ceased at once as if by enchantment.[8] Dr. Arnott, whose original suggestion of a mode for the topical application of cold is described in another part of this article, proposed also the use of congelation by means of a freezing mixture as an anæsthetic in surgical operations, and he first employed it himself to destroy the sensibility of the skin where he intended to establish an issue.[9] M. Velpeau subsequently made use of the same expedient to pro-

[1] Bull. de Thérap., 1. 472.
[2] Lancet, March, 1855, p. 238.
[3] Efficacité de la Glace combinée à la Compression, etc., Paris, 1854.
[4] Fleury, Archives Gén., 4ème sér., xvii. 317.
[5] Beaupré, op. cit., 380.
[6] Faure, Archives Gén., 5ème sér., i. 551.
[7] Bull. de Thérap., li. 258.
[8] Op. cit., p. 211.
[9] Lancet, Sept. 1848.

duce local anæsthesia in the operation of evulsion of the toe nail,[1] and was followed by M. Alquié and by M. Simon, of Nancy.[2] In these cases the toe was surrounded with a freezing mixture of ice and salt for the space of from two to five minutes. The same procedure was successfully employed by Mr. Nunn, of the London Western Dispensary, in order to render the excision of syphilitic vegetations painless. In one case, that of a female, the excrescences occupied the whole extent of the nymphæ and surrounded the clitoris. It is worthy of remark that no hemorrhage followed the operation.

In this country anæsthesia by means of frigorific mixtures has been extensively and successfully employed by Dr. Thomas Wood, of Cincinnati,[3] in minor and superficial operations, such as those for removing *warts*, *small tumors*, and *nævi*, for *opening abscesses*, and the *evulsion of nails*. In *paronychia* he found it unsuccessful, as many others have done. A similar report of its utility is furnished by M. Coste, of Marseilles,[4] who employed it in many and various operations. Dr. J. Mason Warren, of Boston, made use of it with remarkable advantage in removing, by subcutaneous section, a large *nævus* from the integument of the knee-joint, and which was so exquisitely sensitive that the patient previously shrank from the mere approach of the fingers to the part.[5] It has also been used to prevent pain in the *introduction of setons*, the *ligation of arteries and veins*, the operation for *strangulated hernia*, for *paracentesis*, *carbuncle*, *extraction of teeth*, etc.

Generally, when the surgical operation involves subcutaneous tissues or organs, this method has been found inefficacious, either on account of the depth of the incisions required, or because the length of time consumed permitted the flesh to regain its ordinary sensibility. This defect in the method was early pointed out by Mr. Critchett, who, in extirpating a fatty tumor, found that although the incisions through the skin were painless, the dissection of the tumor itself caused the usual degree of suffering.[6] The same defect was observed in an operation for the removal of a tumor from the abdominal walls by Mr. Walton.[7] And although these and similar cases disposed Dr. Arnott to confine his method to operations upon superficial parts,[8] he was still of opinion that the sensibility of the body can be destroyed, to a depth sufficient for most operations, by the use of a freezing mixture in which muriate or nitrate of ammonia is substituted for common salt. A case is reported by Dr. L. A. Dugas, which goes to show that the benumbing influence of cold may penetrate very deeply. A fungous tumor was removed from the arm, requiring a double elliptical incision extending from the acromion process to within three inches of the elbow. The frigorific application consisted of ice and salt; the

[1] Bull. de Thérap., xl. 32. [2] Ibid., xli. 410.
[3] Western Lancet, April, 1854. [4] Times and Gaz., Nov. 1855, p. 517.
[5] New York Journ. of Med., March, 1855, p. 312.
[6] Lancet, Oct. 1854, p. 335. [7] Times and Gaz., Sept. 1854, p. 343.
[8] Month. Journ. of Med. Sci., July, 1854, p. 38.

adipose layer was frozen so hard as to cut like tallow, and the patient experienced so little pain that he suffered more from the dressing of the wound than during the operation itself.[1]

It is claimed by Dr. Arnott for this method that parts which are incised while congealed heal more rapidly than under ordinary circumstances; that, indeed, it tends to prevent traumatic inflammation, while it restrains hemorrhage, and disposes the wounded parts to unite by the first intention. If the skin is merely benumbed, no redness follows the application, and if congelation of the subcutaneous adipose layer takes place, redness of the part follows, and may continue for a day or two, but a true inflammatory condition does not result.

An attempt was early made by Velpeau, as well as by Dr. Arnott, to prevent the growth of *cancer* by congelation. It was, even earlier, argued by Prof. Bennett that a temperature low enough to arrest the progress of a parasitic growth might not be injurious to the sound structures around it, if it were not too long maintained. For some time the treatment was thought to be successful; in several instances it evidently suspended the growth of the cancerous tumor, and palliated the sufferings of the patient in a remarkable manner. But we cannot learn that the success of the treatment has been decided.

Dr. Arnott has made use of the frigorific mixture in a variety of local affections of an inflammatory or only painful character. The following are the most important of them: *lumbago*, *chronic* and *acute rheumatism*, *sciatica*, *rheumatic gout*, *erysipelas*, *eczema*, painful *nodes*, *sprains*, *contusions*, *headache*, *neuralgia*, *toothache*, and *mercurial sore mouth*.

The method recommended by Dr. A. in the application of intense cold is the following:[2] If the congelation is not to be extensive or long continued, a piece of ice of the size of a large orange will be sufficient. This is well pounded in a coarse cloth or bag, and the powder, being placed upon a large sheet of paper, is thoroughly mixed, by means of a paper-folder, with about half its weight of common salt. The mixture is then put into a net of about four inches diameter, and as soon as it begins to dissolve it is ready to be applied. The net is not kept motionless on the part, but is frequently raised, in order that fresh particles of the mixture may be brought into contact with the skin, and the water that escapes from it may be absorbed by a sponge, or allowed to fall into a basin placed underneath. If the surface to be acted upon is of small extent, a very thin and large copper spoon containing the mixture, or a solid brass ball of about a pound weight, which has been immersed in ice and salt, will often answer, and is neater than the net.

The moment a gauze net, or a thin metallic vessel containing a freezing mixture, or a metallic body previously immersed in such

[1] Am. Journ. of Med. Sci., July, 1855, p. 279.
[2] Month. Journ. of Med. Sci., July, 1854, p. 34.

a mixture, is applied to the skin, it is benumbed. There is hardly a sensation of cold produced, and no tingling or smarting. If the contact of the frigorific be continued a few seconds longer, the surface becomes suddenly white, in consequence, doubtless, of the arrest of the circulation; and this change of color is attended with a slight smarting like that produced by mustard. There is now complete anæsthesia, which, if the application were removed, would remain complete for several minutes. But if the frigorific continue to act, another change is produced—the adipose matter under the skin is congealed, and the part becomes hard as well as white. The depth to which the benumbing influence of cold will extend depends upon a variety of circumstances, as the degree of cold, the duration of the application, the vascularity of the part, whether pressure is used or the circulation is suspended, etc. etc. After the usual application of cold for anæsthesia, the circulation soon returns to the part, and the skin assumes a red color which lasts for several hours. If the congelation has been considerable, there is now some smarting felt, unless the natural heat be more gradually restored by pouring cold water on the part, or by placing on it a little pounded ice or a bladder containing iced water. If the process has not exceeded the first stages, there is no smarting, and no necessity, therefore, for such precautions.

Contraindications.—An agent so powerful as cold, and whose effects are so various, must be cautiously employed. In the preceding pages attention has been incidentally drawn to its dangers, yet a more connected but summary view of them may form an appropriate conclusion to this article.

The dangers of drinking cold water when the body is heated by exercise or by a high atmospheric temperature have been sufficiently indicated. The risk is of hardly less magnitude in various morbid conditions of the system, such as feeble digestion and chronic diseases of the stomach generally. The state of gastric atony, which an habitual use of alcoholic drinks engenders, is a serious obstacle to the digestion of water. Cold water is seldom beneficial in pulmonary affections, but tepid drinks, on the other hand, are salutary. Cold drinks ought never to be administered during the cold stage of fever. When there is great debility they are hurtful, except in small quantities, and they must be very sparingly allowed when there is a tendency to congestion in important organs, and during discharges of a critical nature.

Bathing in cold spring water in the summer season, and in water under 50° F. at any season, is attended with risk to old persons and to infants. It is hazardous when the system at large is feeble, whether from a temporary cause or from the progress of organic diseases, when the bath inspires terror, and in all congestive or inflammatory affections whenever there is a predisposition to metastasis or to hemorrhage. Chronic diseases attended with wasting discharges, or in which a sudden shock may be dangerous, are unfit for treatment by cold bathing. The administration of the several partial baths should be governed by the same precepts as that of

general cold baths; they are almost equally objectionable whenever there is extreme debility connected with a local morbid action tending to disorganization.

The rude treatment at first employed by Priessnitz was the natural result of his having learned the system by experiments, at first upon quadrupeds, and afterwards upon hardy Silesian boors, but he was obliged to modify its harshness when his patients were recruited among courtly sybarites and other luxurious denizens of towns. He restrained the sweating and douching practices within narrower limits when he had learned the dangers and mischiefs of their indiscriminate use. Not a few cases were reported of sudden death following his original discipline; very many examples of insanity were among its consequences; organic diseases of the heart were attributed to it; and it was said habitually to depress the animal temperature, and, after having been used for some time, to increase very much the susceptibility to catching cold. A portion of these results may be ascribed to the impoverishment of the blood which has been observed to follow the hydropathic regimen, and in those especially who drink large quantities of water. The symptoms are in the main those of scurvy, viz.: pallor of the integuments, œdema of the face and ankles, a frequent pulse, palpitation of the heart, pale and fetid urine, ulcers of the mouth, and a disposition of all wounds to bleed profusely. We believe that we have seen pulmonary consumption developed by an excessive addiction to the watery regimen. These facts furnish a weighty objection to the method in question as it was originally, or is even now practised, by the speculators in its use; but, as they relate almost exclusively to the results which follow a protracted application of the system, they ought not to be permitted to prevent its judicious employment by capable and conscientious physicians.

Administration.—The modes of employing cold in medicine may be conveniently arranged under the following heads: 1. The simple application of cold by means of baths, irrigations, epithems, and of a low temperature without liquid; 2. Cold, with mechanical stimulation of the skin, *e.g.*, ablution, effusion, the douche, and the shower-bath; 3. Cold so applied as to stimulate the skin permanently.

Cold Baths.—It is not easy to indicate very narrow limits of temperature within which a bath may be called *cold*. At almost any temperature under 70° F. a bath will produce a distinct sensation of coldness, but it has been usual to describe as cold, a bath between 33° and 60° F., and one between the latter temperature and 70° F. as *cool*.[1] The common and safer practice is to begin with the cool, and proceed gradually to the cold bath. Natural baths, however, may be used at a much lower temperature than those prepared at home. Neither should be resorted to immediately after a meal, and seldom within four hours after a full repast. The skin should be moderately warm, and the mind cheerful. Hence a cer-

[1] MITSCHERLICH, op. cit., i. 421.

tain amount of exercise before bathing is beneficial. It renders the impression of cold water more agreeable, and the subsequent reaction more complete. For this reason, doubtless, the bath taken at noon in summer is the most grateful. The early morning bath is next to be preferred, when the body is not only warmed by lying in bed, but invigorated by the night's sleep. Before entering the bath, it is prudent to pour a vessel of water over the head and shoulders, for the purpose of preventing congestion of the brain. During the bath, which may last from five to twenty minutes, the skin should be actively rubbed, and the least chilliness should be a signal for withdrawing. On quitting the water active friction of the whole body should be practised with a coarse towel, until the skin glows. Rest may then be enjoyed, and some light, digestible food taken. But if reaction be not complete, walking in the open air, and if possible in the sunshine, will generally restore the due degree of animal heat.

The frequency of such baths ought to be regulated by the vigor of the patient, the temperature of the air, and their influence upon the health. Once a day is generally sufficient. Sea baths may be taken more frequently, yet seldom more than twice in the twenty-four hours.

Local cold baths comprise those which are applied to the head, the pelvis, or the feet. The first of these is most conveniently taken in the horizontal posture, the head resting in a shallow basin partly filled with water. Habitual fulness of the head, headache, weakness of sight, and even chronic catarrhal affections of the nasal passages, are benefited by this agency. The cold hip-bath is a favorite remedy with the hydropathic sect, in affections of the abdominal organs, such as constipation, piles, etc., and as a method of derivation in diseases of the brain, heart, and lungs. The effect of this bath is decidedly tonic when it is used for a few minutes only at a time, and if the water is quite cold (40° F.). Its derivative influence is obtained by a higher temperature (50° to 60°), and by a longer application, as for an hour at a time. The latter effect is not always attainable without some risk of augmenting internal inflammations or of producing cerebral congestion. It ought, therefore, to be very cautiously, if at all, produced.

By *irrigation* is meant the keeping a constant stream of cold water running over an affected part and the adjacent surface. These should be placed in such a manner, that the water, having served its purpose, may flow freely away, and come as little as possible into contact with the sound parts. It may be supplied from a reservoir, through a simple tube or by means of a flexible siphon. The supply ought to be controlled by means of a stopcock, and should be extremely moderate, but at the same time continuous. In the absence of a siphon, a strip of woollen cloth, several inches in breadth where it is immersed in the water, and gradually tapering to a point, answers the purpose perfectly well; the water must be kept at a uniform temperature; for if this precept be not observed, a series of alterations in the supply of blood to the part takes place,

and the very object of the treatment is defeated. Before suspending entirely the use of irrigation, the temperature of the water employed should be gradually raised, and its quantity diminished until there is little more than dampness left on the affected part.

Under the term *cold epithem* is included every local application of cold moisture, by means of compresses, sponges, and other soft, porous bodies. It is variously employed, according to the object in view. When it is intended that the impression of cold shall be protracted, the application must be constantly renewed, as in cases of cerebral excitement. A degree of cold greater than that produced by cold water or pounded ice may be obtained by the use of artificial mixtures, such as the following: ℞.—Potass. nitrat. ℥ss; ammoniæ muriat. gr. cxx; aceti, f℥iss; aquæ, f℥xx. The anæsthetic applications of freezing mixtures have been described in this article. More generally an antiphlogistic effect is sought, not so much from the primary or transient, or even the more lasting impression of cold, as from the emollient and more durable influence of the moisture. For this purpose wet compresses, covered with a larger piece of oiled silk or some other impermeable tissue, may be employed. Care must be taken to wet the compresses afresh as often as they become dry.

Ablution consists in applying cold water, with more or less friction, to the surface of the body. In addition to the direct impression of the cold fluid, the sense of coolness is prolonged by its evaporation. It is one of the most useful and grateful palliatives which can be employed in fevers attended with a hot and dry skin, and may be resorted to when the disease itself, or the age, weakness, or timidity of the patient, renders more energetic antiphlogistics inappropriate. A more active form of ablution consists in rubbing the skin with cold water and the hand, while the patient sits in a bath-tub half full of water. It should last from five to ten minutes, and be followed by a speedy and complete reaction. A cold foot-bath in which friction is performed by the feet upon one another, is an excellent means of preventing cold feet and relieving headache in feeble and excitable persons.

Affusion.—Jackson thus describes the manner in which he employed cold affusions for typhus in 1794: "The patient was in the first place washed and made perfectly clean by means of soap and water; the skin was rubbed strongly, and under the state of susceptibility and artificial animation consequent to friction, cold water (which was sometimes at a temperature but little above the freezing point) was poured upon the head and shoulders and other parts of the body from a bucket, or it was applied by means of sponges in such manner as to imitate a shower-bath."[1] Currie lays down nearly similar rules, and they are confirmed by the authority of Armstrong. The two last-named writers, however, do not seem to attach so much importance to the preparation of the patient by washing with soap and water. Yet it is a measure which must

[1] An Exposition, etc., p. 19.

exert a powerful influence on the subsequent action of the affusion, and there is good ground for its prescription, if it were only because the ancients employed such alternate impressions of heat and cold, and because they are to this day in vogue among the Asiatics and the eastern nations of Europe.

Jackson pointed out very clearly that merely to abstract heat is not to cure fever, and that therefore the *modus operandi* of cold affusions includes other elements than this. We are rather to look for an explanation of their salutary action in fever in the double movement, first of depression, and then of reaction, which they produce. This indirect stimulation seems to enable the system to assume a more healthful action. To obtain such a result, it is not sufficient to apply cold to the skin, for this, if performed slowly and gradually, will prove the reverse of salutary; but it must be applied with such suddenness and force as to impress the nervous system strongly, and rapidly to abstract heat. In proportion as this is successfully done, will the subsequent reaction tend to terminate in a critical sweat, or at least in a more healthful movement of the circulation. The hotter the skin is, the greater is the probability of such a result. Thus, of all diseases in which cold affusions are salutary, scarlet fever, typhus, and sun-stroke are the most successfully treated by them, and are distinguished by the greatest heat of skin. The ancient system of bathing, and that still practised in Northern Europe, recognize the same principle. The bather, after having been for some time in a hot vapor-bath, where the stimulus is so great as sometimes to produce dyspnœa and palpitation of the heart, plunges at once into cold water, or even rolls in snow. Not only is he not injured by the sudden and violent transition, but, on the contrary, he experiences an indescribable sense of comfort, and perspires freely. In fevers attended by a very hot skin, several repetitions of the affusion may be required to obtain its permanent effect, and even then sensible perspiration does not always indicate the final arrest of the febrile movement. The intimate modification of the vital processes produced by cold affusions in fever is as little known as the nature of fever itself. What simple observation teaches can alone be held as certain, viz., that the nervous system is aroused, the heat of the body lowered, the blood temporarily repelled from the surface, to return more abundantly, imparting to the skin a livelier color, a lower temperature, a softer texture, and a moister surface.

Douche.—This is one of the most potent appliances of the watery regimen, and requires therefore to be circumspectly managed. When rightly employed, its effect is to stimulate and fortify the skin. The sudden and severe shock which it gives to the system renders a state of general excitement the most favorable one for its use, and that excitement in particular which is produced by active exercise. For all useful purposes the douche need not exceed an inch in diameter, nor fall from a greater height than from five to fifteen feet. At the commencement of its use a smaller stream and a less considerable fall are to be preferred, and it should not be

sustained for more than half a minute; but by degrees a larger stream may be borne, and for a longer time. Some persons can endure it for three or four minutes, but only the most robust can expect to escape without injury from such a shock. The douche ought never to be received upon the head, but its blow upon this part may be broken by the clasped hands, and the force of the stream received upon the shoulders, back, and hips. The most suitable time for the use of this bath is before breakfast. Except in very robust persons, reaction does not speedily follow a strong douche bath; as a rule, therefore, the skin should be actively rubbed with coarse towels after the bath, and a walk should be taken briskly in the open air before eating.

Shower Bath.—The shower bath is a modification of the douche, and is formed by water passing through a plate perforated with numerous small holes. It is generally described as being less powerful than the douche, but it so envelops the bather as to take away his breath, and its shock, if less powerful, is also less concentrated, and is therefore borne by a larger surface of the body at once. "It gives a thousand little blows which vex by their minuteness and bewilder by their number." It is nevertheless preferable to the douche when a comparatively gentle stimulus is required, on account either of the age or the feebleness of the patient.

Hydropathic Measures.—Sweating, produced by enveloping the body in dry blankets, and administering cold drinks, although generally described as a part of the hydropathic treatment, was in reality very little used by Priessnitz, and does not belong to the general subject of this article. It consisted, however, in endeavoring to produce active diaphoresis by sweating the patient in blankets, and carefully adjusting them about the neck, so as to prevent, as nearly as possible, all escape of heat from the skin. The head meanwhile was kept cool by wet compresses, and, when once sweating began, small quantities of cold drinks were administered every few minutes. The desired effect was frequently not produced for several hours.

Packing in the Wet Sheet.—This is the most useful and efficient of the processes employed. A large and coarse sheet is thoroughly wrung out of cold water and spread over a blanket previously extended upon the bedstead. The patient lies at full length in the middle of the sheet, which is at once closely and thoroughly wrapped around him, and the blanket is applied over it in the same manner. A feather-bed or a down covering is laid over all. This is a very powerful stimulant, and deserves to be withdrawn from the hands of the charlatans who have converted it into a deadly weapon. Its first impression on persons in feeble or even ordinary health is one of disagreeable coldness, but this soon passes away, and is followed by a mild and grateful warmth. The temperature of the skin gradually rises until it feels hot, the face becomes injected, and general perspiration breaks out, which, if desirable, can be maintained by repeatedly administering small draughts of cold

water. When complete reaction has taken place, the wrappings are removed, and the body is washed with cold water, or the patient plunges at once into the cold bath. This, at least, is the regimen in chronic diseases. In acute affections the sedative action of cold is rather sought for, and as soon as reaction manifests itself, fresh wrappings are applied, and the process is repeated until the pulse is permanently lowered.

The stimulant or sedative effects (for they may be either) of the wet sheet are obtained upon a small scale, and locally, by means of wet compresses. When these are saturated with water, and frequently renewed, they act as refrigerants, and diminish the quantity of blood in the part to which they are applied; but if allowed to remain longer in place, they are simply emollient. The so-called hydropathic belt consists of a bandage five or six inches in diameter, and long enough to go twice or thrice around the body. After having been dipped into cold water, and carefully wrung out, it is very closely wound around the trunk, and a longer and wider dry band is accurately applied over it. It is renewed as often as it grows dry, which is nearly every hour. Compresses are applied in the same manner upon various parts of the body, and particularly upon joints affected with rheumatism, and upon the skin over diseased viscera. The exciting effects of the belt are "manifested in what may be called a depurative sweat, which is at first clear, and is difficult to be procured; but as the treatment advances it becomes more profuse, is viscid and glutinous, of a dark yellow and brown color, sour, and even fetid in its smell, and is sometimes impregnated with the most disagreeable odors. When these morbid phenomena appear, the perspiration may be considered of a critical nature, as if it were the elimination of a morbific humor."[1] The compresses, as well as the belt, produce an eruption of a vesicular, pustular, or simply an erythematous character, and the more abundantly in proportion as the cloths are drier. This effect appears to result from the softening of the cuticle, and the irritation produced by the close contact of the compress or bandage. It is sometimes a useful result, and may, in certain cases of chronic disease, be advantageously substituted for vesication or pustulation by pharmaceutical irritants.

Cold without Moisture.—A convenient apparatus has been proposed by Dr. Arnott for the topical application of cold.[2] It consists of a bladder, into both ends of which tubes provided with stopcocks are inserted, the one to receive cold water from a reservoir, the other to convey it away after having been used. The bladder rests upon the affected part. A freezing mixture may be directly applied to a small portion of the skin, by means of a lamp-glass or tumbler covered with a piece of bladder. If it is desired to affect a larger surface, the mixture may be immediately applied to the skin.

Cold produced by the Evaporation of Ether.—Since the knowledge

[1] BELL, op. cit., p. 300. [2] An Exposition, etc., p. 19.

was acquired that a very low degree of cold may be produced by the evaporation of ether, numerous attempts have been made to apply this knowledge to benumbing parts which were to be incised by the surgeon's knife, and amongst others, by MM. Follin and Leconte, Foucher, Desormeaux, and Giraldès, in France, some of whom contrived an apparatus by which ether dropped upon the skin was at the same time vaporized by a blast of air; but no practical results appear to have been obtained. It remained for the ingenuity of Dr. Richardson, of London, successfully to make use of a fashionable toy for rendering all superficial operations entirely painless. Taking advantage of Siegle's apparatus, with the hand-ball spray producer of Dr. Andrew Clarke, he learned that by directing a jet of rectified ether on the bulb of a thermometer, he could reduce the temperature to 10° F., and produce a degree of local insensibility, but not enough for surgical purposes. He then contrived an apparatus, which he describes as follows: "It consists of a graduated bottle for holding ether, through the perforated cork of which a double tube is inserted, one extremity of the inner part of which goes to the bottom of the bottle. Above the cork a little tube, connected with a hand bellows, pierces the outer part of the double tube, and communicates by means of the outer part, by a small aperture, with the interior of the bottle. The inner tube for delivering the ether runs upwards nearly to the extremity of the outer tube. Now, when the bellows are worked a double current of air is produced, one current descending and pressing upon the ether, forcing it along the inner tube, and the other ascending through the outer tube and playing upon the column of ether as it escapes through the fine jet."[1] By this apparatus a degree of cold of 6° below 0 F. may be produced.

It is necessary that the ether should be perfectly pure, of a sp. gr. not exceeding 0.723, boiling at the temperature of the body, free of all irritating properties, neutral in its reaction, and leaving no smell or moisture behind after evaporation, in all cases in which deep anæsthesia of the tissues is required; but for superficial operations absolute ether is not necessary. It may be mixed with alcohol or chloroform, but in that case the operation is greatly prolonged, and the anæsthetic influence is much less perfect. It is found that congelation of the skin takes place at about 16° F.; and that pure rectified ether does not act as an irritant to the divided tissues.

"When," says Dr. Sedgwick, "the spray is directed to any part, at the proper distance, an inch and a half, much cold is felt, and at the period of blanching, some prickling, which in some sensitive persons amounts even to a sharp pain. The more rapidly whiteness is produced, the less unpleasant sensation there is; and if from the impurity of the ether, or any other cause, this symptom is delayed, much dull aching is felt. The tissues, when frozen, are hardish, and cut brawnily. When the spray is removed, they quickly, and in most cases painlessly, regain life. There is no

[1] Times and Gazette, Feb. 1866, p. 115.

sloughing, only a little redness, and very occasionally some œdematous swelling, and prickling, remaining for a longer or shorter period."[1] According to Dr. Richardson, the tissues do not become perfectly hard, as they do when frozen by a mixture of salt and ice, but are comparatively lax, so that difficult dissections may be carried on with ease and nicety. This is particularly the case when a mixture of ether and alcohol, or of ether and chloroform, is employed, and hence it is preferable to make use of such a mixture when a superficial effect only is necessary, as in opening abscesses, tying nævi, applying nitric acid, etc. But for deeper operations pure ether is required. Moreover, the superficial or deeper action of the anæsthetic can be obtained from absolute ether by varying the distance from which the spray is directed upon the part; at three inches the spray of pure ether is much less refrigerant than when projected from half that distance.

Uses.—Many of the minor operations of surgery may be rendered painless by this method, such as *extraction of teeth*, opening *abscesses*, incising *carbuncles*, tying or cauterizing *nævi*, the introduction of *sutures*, the evulsion of *nails*, the removal of small portions of *bone*, the incision of *fistulæ*, etc.

But operations requiring much larger and deeper incisions, have been successfully performed, and without pain, with its assistance, such as the removal of *tumors*, fatty, sebaceous, scirrhous, and others. The entire *breast* has been removed in several instances without pain, and numerous needles thrust into a *hydatid tumor* of the liver with little suffering to the patient. Even in *ovariotomy* the pain of the operation has been materially reduced by anæsthesia of the integuments; and in a remarkable case of *Cæsarean section* nearly the whole pain of the operation, and the apprehended hemorrhage were prevented; and, although the child died soon after birth, the mother recovered without a single untoward symptom.[2] *Amputations* of limbs, and one, at least, at the shoulder joint,[3] have been performed with diminished suffering.

Among the instances of the successful application of local anæsthesia, in cases not surgical, may be mentioned the following: Ether spray has been applied over the lumbo-sacral region, with the view of mitigating the pains of *parturition*, and to the hypogastric region to arrest post-partum *hemorrhage*, and promote *contraction of the uterus*. In several severe cases of facial *neuralgia* it has afforded prompt relief, and a case of *chorea* is reported, in which two applications of the vapor to the spine effected a cure.[4]

It is unnecessary to furnish the details of these interesting reports. Enough has been said to show how wide a field of usefulness is open to the new invention for the relief of human suffering.

In 1866, Dr. Henry J. Bigelow proposed as an anæsthetic a liquid hydrocarbon obtained by distilling petroleum,[5] which he

[1] Lancet, April, 1866, p. 394.
[2] Times and Gazette, April, 1866, p. 362.
[3] Bull. de Thér., lxx. 406.
[4] Ibid., lxxii. 89.
[5] Boston Med. and Surg. Journ., April, 1866, p. 238.

denominated RHIGOLENE (ῥῖγος, extreme cold). It is the lightest of all known liquids, having a sp. gr. of 0.625, and its boiling point at 70° F. It is very inflammable. Used with an ordinary hand spray producer furnished with metal tubes, it readily produces a temperature of 15° below zero. It is, therefore, more sure of producing congelation than ether. It is also less expensive than that liquid. If long applied to the skin, congelation may be followed by redness, desquamation, and "if continued or used on a large scale, the dangers of frost-bite and mortification must be imminent."

ACIDUM HYDROCYANICUM DILUTUM.
DILUTED HYDROCYANIC ACID.

Preparation and Properties.—This acid is prepared by distilling ferrocyanide of potassium with sulphuric acid and water; or extemporaneously, by agitating cyanide of silver, fifty grains and a half, with muriatic acid forty-one grains, and distilled water a fluidounce, in a well-stopped vial.

Officinal hydrocyanic acid contains but two per cent. of anhydrous acid, and possesses, of course, the essential properties of the latter in a low degree. Owing to its susceptibility to decomposition by light, it should be kept in bottles covered with black paint or paper, and be renewed from time to time. According to Dr. Christison, this decomposition does not take place so readily when the acid is prepared by the action of sulphuric acid on ferrocyanide of potassium, and seems in a great measure to be prevented by the presence of a small excess of the acid just named.

Anhydrous hydrocyanic acid is a clear, transparent liquid, which is extremely volatile, and freezes by its own evaporation at 5° F. Its boiling point is 80° F. Light readily decomposes it and renders it yellow or brown. Its taste is at first cool and afterwards burning; its odor resembles that of bitter almonds, and it is irritating to the nostrils. Its vapor is inflammable, and burns with a reddish-yellow flame. Its acid reaction is very feeble, as it reddens litmus very slightly. It is partially soluble in water, but perfectly so in alcohol, ether, and the ethereal oils.

History.—The well-known pigment, Prussian blue, was discovered by Diesbach and Dippel at Berlin in 1704. Nearly half a century later, Macquer found that alkalies decomposed and decolorized Prussian blue; and in 1775, Bergmann announced that the coloring principle of this compound was an acid. Scheele was the first to isolate this substance. In 1782, he demonstrated its properties, and pointed out new and more perfect methods of preparing it, but it was not until 1815 that the acid was obtained in a pure and anhydrous state, by Gay Lussac, who also gave the name cyanogen to its radical.

Hydrocyanic acid exists naturally in numerous plants. It has been obtained from the leaves, flowers, and kernels of peaches, cherries, plums, and bitter almonds, from the leaves of the cherry-

laurel, the bark of the wild cherry (*Prunus Virginiana*), etc. In some of these it does not exist already formed by nature, a statement which would seem scarcely reconcilable with their well-known poisonous qualities, when taken in substance, although the fact is attested by ancient authorities and made familiar by modern experience, had not science proved in what manner the poison is developed out of the elements furnished by the plants on the one hand, and the animal economy on the other. Dioscorides mentions that bitter almonds are poisonous to foxes and other animals, and even to men, when eaten in large quantities, and his statements are fully confirmed by Matthiolus, Wepfer, and others.[1] It would appear also that this substance, or, as some suppose, its radical, is, under certain circumstances, a product of the animal economy. Fourcroy relates that "a woman, aged about thirty years, labored under a nervous and melancholic affection in consequence of protracted grief. The principal seat of her suffering was in the epigastric region. She became exceedingly emaciated, and had hectic fever, with a livid paleness of the skin. After a few days she was seized with a convulsive trembling and faintings, which were followed by the discharge of drops of blood from the edge of the eyelids, the nostrils, and the ears. The linen with which the blood was wiped off was marked with spots of a beautiful blue."[2] A similar case is given by Coulton, in which pus from the wound of an extirpated cancer continued during five days to tinge the linen of a fine blue color.[3] Dr. Pereira met with a very analogous instance. Dr. Batt, of Genoa, found in the urine of a little girl, of seven years of age, a dark blue sediment, which proved on analysis to be prussiate of iron.[4] Numerous cases of a similar description have been more recently reported. It has been supposed that the poisonous matter of decaying cheese and pork is closely allied to the acid under notice, which is also alleged to have been clearly detected in ergot, a substance which, it is well known, is apt to produce gangrene of the extremities when used with the food for any considerable time.

Hydrocyanic acid produced by chemical processes was first employed in 1804 by Borda, for the same diseases in which he had been accustomed to prescribe the oil and distilled water of cherry-laurel. Soon afterwards, Brera, of Padua, and Rasori, contributed by their favorable reports of its effects to bring the new and powerful agent into vogue, while Magendie, in France, and Granville, Elliotson, and others, in England, drew very general attention to its medicinal employment. But the reality of very few among the virtues it was at first supposed to possess, has been established by continued experience, and at the present time the therapeutical applications of the acid are comparatively few and unimportant. This result may be attributed less to its intrinsic

[1] WIBMER, Wirkung, etc., i. 154.
[2] Am. Med. Recorder, ii. 516.
[3] Ibid.
[4] SIGMOND, Lancet, 1836–7, ii. 745.

want of medicinal powers, than to the alarming and sometimes fatal consequences of its incautious administration.

Action. *On Vegetables.*—If two hyacinth bulbs are placed, the one in a vessel containing pure water, and the other in a vessel filled with cherry-laurel water, the first will send out roots, stem, and flowers; but the second will give no signs of vegetation, and the roots will die and begin to putrefy in a few days.[1] Seeds lose their power of germination, and the leaves of the sensitive plant their irritability, by immersion in water impregnated with hydrocyanic acid. Its hostility to vegetable life has been thoroughly illustrated by Mr. Nunneley.[2] He employed in his experiments a great variety of plants, of which corresponding cuttings or roots were placed in similar vials, with and without the acid. The vials contained one and a half fluidounces of water, and those containing the acid and the water respectively were kept in different rooms. The quantity of acid employed was six, ten, and thirty minims in several series of experiments; and in another one, the plants were placed in glass jars of the capacity of a pint and a half, ten minims of acid were introduced, and the top of the jar was closely covered over. After giving the experiments in detail, the author remarks that they "will probably be regarded as sufficiently numerous to show that hydrocyanic acid affects vegetables generally. . . . The most remarkable effect of the acid, whether the plant be exposed to the influence of the vapor, or be put into a weak solution, so that it may be absorbed within the tissues, is the complete prostration of all the power of the plant; it becomes shrunk, feeble, and dry, or if it be a succulent plant, moist, often with the sap exuding from the stem. The condition of the plant strongly resembles that of animals when in a state of paralyzation from a dose of the acid, or the extreme flaccidity immediately after death, before the commencement of rigidity. The acid soon disappears, being either decomposed or absorbed; for a few hours after the experiment no smell of it was perceptible."

On Animals.—Hydrocyanic acid is poisonous to all animals, but acts rather less rapidly upon the cold than upon the warm blooded. According to the experiments of Dr. Preyer, of all animals those most easily affected are birds; next in order follow mammals, reptiles, amphibious animals, and fishes.[3] Shrader, of Berlin, in 1802, was the first to illustrate its terrible power, which the experiments of Emmert, Coullon, Schubarth, Magendie, Lonsdale, and Nunneley have amply confirmed. When the effects produced by a dose of hydrocyanic acid are not too rapid to be observed, the earliest appears to be giddiness, with a loss of muscular power and control over the combined actions of the muscles; the head droops, the mouth gapes, the tongue protrudes, there is apparently a sense of distress and constriction in the fauces, and the respiration is hurried

[1] DUVIGNAN and PARENT, Med. Record, ii. 553.
[2] Trans. Prov. Med. and Surg. Ass., N. S., iii. 58.
[3] Glasgow Med. Journ., ii. 231.

and panting; according to some observers (Preyer) there is a diminution of the rate of breathing without antecedent acceleration. The pulse-rate, which at first is accelerated, becomes notably retarded and irregular. The unsteadiness and loss of power are speedily succeeded by spasm, frequently of the most intense kind. It may be either tonic or clonic, according to the strength of the dose of acid, and the susceptibility of the animal. If the spasm be tonic, not only do the voluntary muscles continue rigid, but the heart is, at least to the same extent, involved. It ceases to pulsate, and the respiratory muscles are affected with spasm. Hence the lividity and bloated appearance of the face, the protrusion of the eyes, and the excessive congestion of the veins. In this condition of the two all-important functions is to be seen one of the causes of the almost instantaneous death which takes place in some instances. When, however, the dose of the acid is less, or the susceptibility of the animal not so great, the rigidity of the muscles soon abates and gives way, and is followed by more or less complete paralysis; at the same time the respiration either becomes excessively rapid, the chest being but little expanded, or it is very slowly performed, and is deep or sighing. The heart beats very rapidly and feebly. This state of paralysis may continue, the weakness gradually increasing until the animal dies, or, as more generally occurs, the creature is convulsed and paralyzed at intervals, the heart continuing to beat very feebly for two or three minutes after all signs of sensation and motion have ceased; though, by no means unfrequently, a strong convulsion immediately precedes death.

During the progress of these phenomena the temperature rapidly falls, in some cases from 37° (C.) to 35° (C.), or from 99° to 95° F. Preyer presents the following summary of the phenomena of prussic acid poisoning: 1. Difficulty of breathing, diminished heart-rate, full pulse, giddiness, tottering, and then the animal falls. 2. Violent spasms, enlargement of the pupil, loss of consciousness, frequently a cry, vomiting, muscular rigidity, during which the heart and respiration cease, loss of motion; the convulsions cease. 3. Collapse, general relaxation of the muscles, sensibility diminished or destroyed, occasional respiratory twitches, pulse feeble and irregular; irritation sometimes induces tetanic spasm, which is not survived; but death commonly occurs without spasms. For several hours the eyes retain a peculiar lustre. It results from the experiments of this author and of others, that the first function affected is respiration; the inspirations are much deeper than usual, while the expiration appears shortened; and that simultaneously, or immediately afterwards, the action of the heart is either rendered preternaturally slow, or it beats with short, rapid, and incomplete pulsations. If the animal recovers, it will often lie in a complete state of paralysis; but after a time slight convulsive movements of the limbs, or some spasmodic action in respiration may be observed. These gradually grow stronger, until the convulsions often become very powerful. The animal howls loudly, reflex

action returns, and, subsequently, sensation. But for some time it continues very feeble, is indisposed to move, and has very little command over its muscles. If it survives, the symptoms resemble those from opium in the deep, quiet sleep, and indisposition to be aroused from it, while the condition of the pupil is variable, being often, at this stage, by no means dilated. The acid acts locally as well as generally. When dropped into one eye of an animal, the pupil of the eye is sooner, and to a greater extent, dilated than that of the other; and when the acid is administered by the rectum or the vagina, both hind legs are sooner affected than the anterior portion of the body. But the constitutional symptoms appear almost as rapidly as if the poison had been swallowed. Much has been said of the shriek which often precedes death from hydrocyanic acid. It is by no means a constant occurrence, but, when it does take place, the cry is of so peculiar a kind, and so indicative of severe distress, as to give the idea of consciousness of impending death on the part of the animal. *Post-mortem* examinations, whether made immediately after life has ceased, or some time afterwards, throw some light upon the cause of death. If the body be opened while the heart is pulsating, it will be found that when death has been long delayed, or the dose of acid very small, the blood is usually dark in color, and uncoagulated, alike on both sides of the heart, and all the cavities of the viscus may contain more or less of it, especially the right, which is often much distended; while, on the contrary, if the death has been sudden, in almost every case the left side of the heart, and especially the ventricle, is found to be perfectly empty and rigidly contracted, while the right side of the heart contains blood, being in some cases, though by no means always, much distended. Lecorché and Meuriot, however, state that the heart is always in diastole, and is so distended as to project from the chest when it is opened. The stomach, or whatever part the acid had been applied to, is almost invariably found reddened. The veins of the brain, and indeed throughout the body, are remarkably engorged. According to the authorities just named, there is a diffused injection of the parenchyma of the lungs, while ecchymoses are observed underneath the pleura, intermixed with emphysematous patches, especially in the upper lobes. Cadaveric rigidity is probably greater after death from hydrocyanic acid than after death from other causes.

There is no fixed quantity of the acid which will invariably destroy life. The more vigorous the animal, *cæteris paribus*, the larger is the quantity that may be taken. In like manner, a smaller dose is fatal to young animals than to the old, although for very young animals large doses are required. The degree of concentration of the acid has no very material influence over its action. Given on successive days, hydrocyanic acid does not show a cumulative action, but rather the reverse; it is more probable that the system becomes habituated to it, and by repetition will endure a dose which, if given at first, would have been destructive to life. It was curious to observe, says Mr. Nunneley, that, however help-

less and paralyzed a dog might be lying, if another dose were given, the first and *immediate* effect of it was to rouse the animal, and often to produce violent motion.[1]

When introduced by the rectum or vagina, or applied to wounds or to the conjunctiva, hydrocyanic acid occasions the same series of symptoms which have been described, but more gradually. Injected into the veins it may destroy life instantaneously, and when inhaled in a concentrated state it is scarcely less immediately fatal.

According to Dr. Robert Amory,[2] the horse is nearly insusceptible to the poisonous action of hydrocyanic acid. In different experiments, half an ounce, an ounce, and even two ounces of the acid were given to horses already weakened by disease, with an exhilarating rather than a sedative effect. Dr. Shattuck was unable to kill a hyæna with half an ounce of the poison given by the mouth.

On the other hand, it is recorded that an elephant that had become wild was poisoned by an ounce of hydrocyanic acid mixed with rum. The animal, after sucking it up, spurted it out again; it then began to tremble, and in a quarter of an hour it was dead.

On Man.—The phenomena occasioned in man by hydrocyanic acid may be conveniently studied under three heads: the effects, 1st, of small or medicinal doses. 2d, of those which are poisonous, but not immediately, if at all, fatal. 3d, of those which are directly destructive of life.

Under the first head may be mentioned irritation of the throat and windpipe, an increased flow of saliva, a sense of heat in the epigastrium, diffusing itself over the whole abdomen, and even to the entire surface, constriction and heaviness of the head, dizziness, buzzing in the ears, headache, numbness, duskiness of the countenance, staggering, laborious respiration, constriction of the chest, often palpitation of the heart, inclination to vomit, but sometimes a feeling of emptiness in the stomach, and a craving for food, a quick and excited, or an unusually slow pulse, and, for some hours after these symptoms, a sense of weariness and an inclination to sleep. These phenomena occur more readily in feeble than in robust persons.[3]

Examples of the second class are seldom met with; for when much more than the due medicinal dose of the acid is taken either by accident or design, it almost always proves rapidly fatal. The following, which are the symptoms that occurred in the case of Dr. Bertin, of Rennes, may serve to illustrate this class. Dr. B. had already more than once taken a dessertspoonful of the medicinal acid without injury, and on the present occasion procured from an apothecary a like dose of the medicine prepared by one of the best chemists of Paris, and swallowed it in two mouthfuls, before leaving the shop. Almost immediately afterwards he fell down as if struck by lightning. His symptoms were the following: loss of consciousness and sensibility; trismus; a constantly increasing

[1] Op. cit., p. 84. [2] Boston Med. and Surg. Journ., Aug. 1866, p. 73.
[3] Compare Becquerel, Gazette Méd. de Paris, 1840, No. 1 et seq.

dyspnœa; cold extremities; a noisy and rattling respiration; the characteristic odor of the acid upon the breath; distortion of the mouth; and a thready pulse. The face was swollen and dusky, and the pupils fixed and dilated. The trismus increased, and was soon accompanied by opisthotonos. At the end of an hour a violent convulsion came on, the whole trunk grew stiff and the arms were twisted outwards. The convulsive attacks were repeated, but did not last more than a few minutes. The abdomen was distended with flatus, and continued to enlarge. After two hours passed in this condition, the patient began to regain his consciousness, said that he had taken prussic acid, and begged that he might have more air and be allowed to die in peace. The mind gradually became clear, but there was marked dyspnœa, and from time to time a fit of coughing, which caused the expectoration of a little opaque, whitish mucus. There was no paralysis whatever. About nine hours after the accident the patient was taken home, and walked up stairs to the second story without assistance. For several days he experienced the symptoms of a pulmonary catarrh, which may have been unconnected with the poisoning; his urine was scanty, and he complained of a sense of stricture across the chest. He was not able, for a fortnight after the accident, to leave the house.[1]

In another case[2] a man swallowed by mistake about twenty-three grains of cyanide of potassium. In the course of two minutes he became senseless. Respiration was slow and labored; pupils dilated and fixed; eyes open and protruding; conjunctivæ slightly injected; face and neck congested and livid, the veins being very prominent; skin of head hot; temperature of extremities normal; pulse full, bounding, regular, and rapid. The muscles were at first relaxed, but afterwards convulsive movements of the limbs took place, followed by their rigidity and slight opisthotonos, the pupils becoming contracted and fixed, and the pulse very feeble. The whole convulsive paroxysm lasted about one minute. By evening he had almost completely recovered, and on the following day felt perfectly well.

In the third series of cases death may take place without being preceded by any definite symptoms. MM. Trousseau and Pidoux say: "We have witnessed three cases of poisoning by prussic acid. *There were no convulsions.* The first phenomenon observed was a profound stupor, an immediate and almost total extinction of animal life. The pulse could not be felt at the wrists or temples, but was perceptible in the neck, and very faintly in the groin. The breathing was hurried, but not labored, and interrupted occasionally by deep sighs. The pupils were widely dilated." These phenomena are merely those of the act of death, and although, for obvious reasons, they are seldom witnessed at their inception, there is evidence enough that they may begin and end within the space of one or two minutes, and display themselves even while the poison is in

[1] Revue Méd., xvii. 265.
[2] Boston Med. and Surg. Journal, May, 1866, p. 311.

the act of being swallowed. In a case communicated to us by H. Clay Hall, Esq.,[1] a male, 56 years of age, was seen within five minutes after swallowing the fatal dose. The muscles were relaxed and flaccid, except those of the lower jaw, which were rigid. The hands were folded across the breast, as if in repose; the eyes fixed, but life-like, the pupils in their normal condition; the respiration slow and deep-drawn, but not labored; the pulse, about 50, when first felt, became slower and feebler to the moment of death. There was no clammy perspiration. Death took place in about seventeen minutes from the moment when the poison was swallowed. At the moment of dissolution the pupils dilated, and death occurred by the mere cessation of breathing. The veins of the neck and face were strongly congested. Shortly after death the life-like appearance of the corpse was surprising, and thirty-six hours afterwards the eye retained its brightness.

The *post-mortem appearances* after poisoning by hydrocyanic acid are very slight. Externally, the body is commonly livid, or the skin is tinged of a violet color; the nails are blue, the fingers clenched, and the toes contracted; the jaws firmly closed, with foam about the mouth, the face bloated and swollen, and the eyes have been observed to be glassy, very prominent, and glistening. Internally, the venous system is gorged with dark-colored blood: the veins of the brain and spinal marrow, of the solid viscera of the abdomen, and of the lungs, as well as those emptying into the heart, and the right side of this organ itself, are distended with blood. This fluid is uncoagulated, is of a dark bluish-black color, and tarry consistence. Like the organs, it generally smells distinctly of the acid. The mucous membrane to which the acid has been applied is usually reddened. The irritability of the muscles of organic life is much diminished.[2]

A *rationale* of the symptoms occasioned by hydrocyanic acid can only be inferred from a careful analysis of them, since no organic change capable of explaining them can be detected after death. Since the phenomena are nearly identical in man and in the lower animals, those derived from both sources may be used to elucidate the *modus operandi* of the agent under consideration. It has already been seen that in quadrupeds the immediate consequences of a fatal dose of the acid, so far as they relate to the point under consideration, are general spasm of the muscular system, and death from an arrest of the action of the heart and lungs. If, instead of taking place immediately, death be postponed for half an hour or longer, spasm is followed by debility of the muscles of animal life, while those of the heart and thorax act more rapidly to compensate for their feebleness; the pulse is frequent and faint, and the breathing hurried and short. In this condition the struggle between life

[1] Am. Journ. Med. Sci., Jan. 1868, p. 277.

[2] The following more recent cases may be consulted. LIDDELL, N. York Med. Journ., vi. 407; OGLE, St. George's Hosp. Rep., iii. 218; Guy's Hosp. Rep., 3d ser., xiv. 259; Annales d'Hygiene, ix. 332; SHAPLEIGH, Am. Journ. of Med. Sci., Oct. 1869, p. 421; PACKARD, ibid., p. 432.

and death is demonstrated by the recurrence of more or less general spasms, which either exhaust the system, and directly destroy life, or, growing feebler themselves at each return, at last leave the vital powers triumphant. A more definite and physiological explanation of the mode of action of prussic acid in causing death may now perhaps be attempted. Long ago Kölliker concluded from his experiments upon frogs that the poison directly and primarily produces cerebral paralysis, and then affects the spinal marrow, destroying first its reflex, and afterwards its direct motory functions, and that it paralyzes the heart, and permits it to become distended with blood.[1] Later investigations have given to this statement more precision and accuracy. In 1862, Dr. Joseph Jones, of Nashville, Tenn., performed a series of experiments upon ten young alligators, by applying prussic acid to the mouth, brain, spinal marrow, and medulla oblongata, and concluded that the acid "acts primarily, directly, and chiefly upon the medulla oblongata and the spinal cord; and that its ability to produce death is dependent upon its action on the medulla oblongata."[2] In 1868 were published the Essays of Dr. Preyer, above referred to, and of MM. Lecorché and Meuriot.[3] From these it appeared that when the pneumogastric nerves are divided in an animal, a much larger dose of the acid, however administered, is required to cause its death than if the nerves had remained intact. Hence it was inferred that the peripheral termination of the pneumogastric nerves, especially in the lungs and heart, must be regarded as primarily attacked by the poison. According to MM. Lecorché and Meuriot this action is not direct, but reflex, at least in cases of rapid death, and is in its nature syncopal, whereas, when death is delayed, or when the symptoms threaten it, "the dyspnœa and asphyxia must necessarily be ascribed to the condition of the medulla oblongata." The convulsions which so commonly occur, when death is not immediate, are very probably of similar origin.

Remedial Employment.—MM. Trousseau and Pidoux, on reviewing the evidence in favor of hydrocyanic acid as a medicine, arrive at the conclusion that "it is often dangerous, almost always useless, and very rarely curative." This judgment is scarcely impartial. Undoubtedly a great many of the expectations which were indulged of the usefulness of the medicine have, as in the case of nearly all new agents, been disappointed; but a fate which befalls the good and the worthless alike ought not to be made a ground of condemning the former. From the following summary it will be perceived that the medicine has just claim to confidence in the treatment of several diseases.

Spasmodic and Painful Diseases. Whooping-cough.—In no other affection has the value of this medicine been more highly exalted, and there is apparently some ground for a favorable opinion of its merits. Dr. E. P. Atlee[4] prescribed it for children and adults in

[1] Virchow's Archiv, x. 288.
[2] Med. Record, Dec. 1867, p. 457.
[3] Archives Gén., 6ème sér., xi. 529.
[4] Am. Journ. of Med. Sci., x. 128.

more than two hundred cases of the disease, which it cured in from four to ten days, or at furthest in a fortnight. He employed a preparation containing four and a half per cent. of the pure acid, of which five drops were mixed with an ounce of syrup, and of this mixture a teaspoonful was given three or four times a day to a child from six to twelve years of age. Dr. Hayward[1] found, in the latter stages, when there is little or no mucus in the lungs, nor any tendency to congestion of these organs, that two or three doses of the medicine would put an end to the disease. Richter[2] also considered it as useful towards the termination of the attack, but inefficient at its height, and in this opinion various other authorities coincide. According to Dr. West, if the paroxysmal character of the cough is well marked, and the fits are of frequent occurrence, but the child in other respects ails little, much benefit will accrue from the use of hydrocyanic acid. It sometimes exerts an almost magical influence on the cough, diminishing the frequency and severity of its paroxysms almost immediately, while in other cases it seems perfectly inert; and again, in others, without at all diminishing the severity of the cough, it exerts its peculiar poisonous action on the system so as to render its discontinuance advisable.[3] This statement explains why some persons question its efficacy altogether, and why other physicians employed the remedy successfully in one epidemic but failed to derive any benefit from it in subsequent ones. The latter circumstance has been plausibly explained by the greater mildness of the disease on the first-mentioned occasions. On the whole, it appears to be a useful medicine in mild attacks of whooping-cough, and generally during the decline of the affection. Dr. West prescribes a dose of half a minim of the acid every six hours for a child nine months old, gradually increasing the dose to one minim every four hours for a child of that age, and so in proportion for older children. If the child appear faint, or dizzy, or bewildered, after its administration, the dose should be diminished or the medicine suspended. The following formula is used by Dr. W.: ℞.—Acid. hydrocy. dil. ♏iv; Sodæ bicarb. gr. x; Mist. amygdal. ℥j.—M. S.—A teaspoonful every sixth hour for a child nine months old.

Simple nervous cough, apparently independent of pulmonary disease, is sometimes of great urgency and violence, and while it seems to be kept up by an irritable state of the system, appears to be aggravated by opiates and the usual expectorant remedies. For this affection there is no more certain palliative than hydrocyanic acid. Dr. Hayward and numerous authorities concur in this opinion. In *spasmodic asthma* its benefits are much less distinct; indeed, so many remedies excel it in relieving this complaint that it need scarcely be employed in its treatment.

In other spasmodic affections its advantages are by no means eminent. Andral and Becquerel, who experimented extensively

[1] Am. Journ. of Med. Sci., iv. 51.
[2] Op. cit., ii. 523.
[3] Diseases of Children, 3d ed., p. 342.

with the medicine, found that, in severe cases of hysteria and in the nervous symptoms that attend chlorosis, it was altogether inefficient. A case of *spasmodic dysphagia* is reported by Richter,[1] which, from its degree and long duration, as well as from the extreme emaciation it had caused, was thought to be organic, but which was rapidly cured by hydrocyanic acid in conjunction with counter-irritation of the neck. In *dysmenorrhœa* this remedy seems occasionally to have acted as a palliative. In a case of *angina pectoris* Schlesier found that it afforded immediate and very decided relief. In *diseases of the heart* Andral and Becquerel regarded it as more injurious than useful. Richter found it beneficial in *neuralgia* resulting from cold or combined with a *rheumatic* element; and Dr. Coates[2] reported two cases of the latter description in which it procured a more decided advantage than the other remedies employed.

Gastralgia.—One of the earliest applications of the remedy in England was to the relief of this form of *dyspepsia*, for which it was first generally introduced in that country by Dr. Elliotson.[3] He prescribed it in cases of which the main symptoms were pain and tenderness of the epigastrium; and although the previous duration of the disease varied from a few weeks or months to as many years, it yielded with great rapidity. In another series of cases epigastric pain and tenderness were accompanied by such symptoms as flatulence, vertigo, headache, loss of appetite, nausea, pyrosis, vomiting, nervousness, palpitation of the heart, cough, and dyspnœa. In these, too, the acid was equally successful. This application appears to have been originally suggested by Sprengel, who doubtless drew the idea from a similar use of laurel-water in the last century. Dr. A. T. Thomson, perhaps without a knowledge of these circumstances, also suggested its use, and even at a much later period continued to believe that no remedy is so well adapted, as an adjunct of tonics, for removing those dyspeptic affections which are attended with irritability of the mucous membrane of the stomach, and accompanied with heat and soreness, and elongation of the papillæ of the tongue.[4] In 1828, Dr. Bailey published a tabular record of cases similar to those of Dr. Elliotson. Their prominent symptoms were epigastric tenderness, indigestion, flatulence, and palpitations of the heart. He prescribed three minims of the British officinal hydrocyanic acid three times a day, and cured all of his cases in from one to three weeks. Its effects were striking from the first days of its administration.[5] All of these writers regarded the medicine as improper when the dyspeptic symptoms were attended by fever. Dr. Pereira contributed to the history of the complaint in question several striking examples of the prompt and permanent relief of its symptoms by this medicine. But, as he remarks, it is attended either with perfect success or perfect failure. It not only allays pain, but relieves *vomiting*. *Enteralgia* is no less certainly

[1] Op. cit., ii. 523.
[2] Med. Recorder, iv. 146.
[3] Med.-Chir. Rep., 1821, i. 639.
[4] London Dispensatory, p. 839.
[5] Lond. Med. Repos., April, 1828.

and immediately palliated by this remedy, and in most instances is permanently cured by it. Dr. Prout has found it useful in the pains of *colica pictonum.*

The sedative action of hydrocyanic acid has been employed by Dr. K. McLeod to allay excitement in *mania* and other active forms of *insanity.* Although he admits that in the greater number of his cases its benefits were slight, or, at most, transient, yet he claims that in a certain proportion, about one-fifth of the whole number, the medicine was the main cause of a rapid restoration of reason. The dose varied from two to six minims, repeated every fifteen minutes, or at such intervals as were required to sustain its specific action. It was administered by the mouth and also by subcutaneous injection.[1]

In *chronic pulmonary affections*, and even in phthisis, hydrocyanic acid was at one time extravagantly praised by several English and other European writers, who acquired a wide-spread notoriety by their alleged success in its employment. Foremost among them were Dr. Granville[2] and Magendie, whose reports of success bordered on the marvellous, but which neither contemporaneous nor more recent experience has confirmed. The whole value of the medicine in consumption is now well ascertained to consist in its power of allaying the cough.

Acute inflammation, of the lungs especially, was at one time supposed to have encountered a specific cure in the acid under notice. Great was the surprise of the physicians and students, says an Italian writer,[3] at Borda's clinique in the hospital of Pavia, when they saw these affections yielding as if by enchantment to the use of the medicine. The fever ceased immediately; a gentle moisture appeared upon the skin; the pulse fell, and resumed its normal characters; a salutary expectoration took place; the pains and the cough vanished away. Some years afterwards Brera obtained equally favorable results at Padua, and in these cities, as already related, the medicine began its vogue. The long list of authorities who vouched with no less confidence than these writers for the virtues of the remedy contains the names of distinguished men, and their enthusiastic assertion of its powers in many curable, and even incurable, diseases, stands on record to swell the proof of the fallibility of human testimony where facts and opinions are not sufficiently distinguished from one another.

External Use.—A number of writers agree in testifying to the utility of this acid in certain cutaneous affections attended with itching. Dr. Thomson, particularly, regards it as the only application that can be depended on for allaying the itching and tingling which are so distressing in *impetiginous affections.* He directs it to be used in the proportion of f℥iss to f℥viij of water. Schneider, of Dusseldorf,[4] has also employed it successfully in various cutaneous

[1] Times and Gaz., March, 1863, p. 262.

[2] History and Practical Treatise on the Internal Use of the Hydrocyanic Acid in Pulmonary Consumption, etc. Second edition. London, 1820.

[3] GIACOMINI.

[4] MÉRAT and DE LENS, ii. 549.

eruptions, and especially in those of the genital organs, for the purpose and after the manner above described.

Dose and Administration.—The average dose of medicinal hydrocyanic acid is two or three minims, given several times a day in some mild and simple vehicle, such as gum-water, syrup, or orange-flower water, with a few drops of alcohol, and cautiously and gradually increased until a slight degree of giddiness or faintness is produced. The most prudent plan is to begin with one minim as the minimum dose, and augment it rapidly until the average is reached, when its further increase should be very cautiously directed. In order to more clearly designate the preparation, as well as to shield it from the action of the light, the vial containing it should be made of blue glass, or else covered with black paper or varnish. Whenever the medicine is renewed, the risk of employing a sample of unascertained strength should be avoided by giving at first the minimum dose.

As a wash it can be employed after the manner described above. Christison directs one part of the medicinal acid in two hundred parts of water, which may be increased afterwards to twice or thrice that proportion. Drs. Wood and Bache prescribe from thirty minims to a fluidrachm, in a fluidounce of distilled water. But care must be taken to use only the weakest solution whenever there is the least abrasion of the skin, for alarming symptoms have followed a neglect of this precaution, and it is said that signs of poisoning have followed an application of the pure acid even to the sound skin.

Antidotes.—"I know of no antidote to hydrocyanic acid," is Mr. Nunneley's conclusion from his numerous and carefully conducted experiments with this substance. He found *chlorine* of little or no value in moderating the effects of the poison. For practical purposes, too, it could seldom be accessible. Unlike most other poisons, hydrocyanic acid, taken in large doses, leaves but little time for interference, and the only reliable remedies, as a general rule, must be such as are always at hand. For this reason *electricity* and *galvanism* could seldom be employed, even if they were efficient; but, although proposed, and even vaunted, there is no ground whatever for confidence in them as practical resources against this poison. In regard to *ammonia*, which has been considered the chief resource by some experimenters, Orfila concludes that it is very decidedly useful if properly employed; that is to say, if the preparation be not strong enough, or so constantly applied as to cauterize the mucous membrane with which its vapor comes in contact when inhaled. Mr. Nunneley's experiments do not contradict this statement, although his general conclusion does. He thinks that it may be useful in cases where the dose has been so small as to leave it uncertain which way the balance of life will turn; but he does not appear to have applied ammonia so that the poisoned animal should duly inhale it, but rather to have rubbed it upon the skin, or immersed the animal in a vessel containing more or less of the vapor of ammonia. If, as there is reason to suppose, this agent operates only by means of its stimulant properties, and that chiefly through

the Schneiderian membrane, these methods of testing its virtues were clearly inappropriate. *Artificial respiration*, produced by compressing the thorax, although nothing more than a subordinate resource, ought never to be neglected, and the same may be said of *shaking*. Indeed, Mr. Nunneley was inclined to estimate the value of the latter as high as anything he tried. But of all the resources against poisoning by hydrocyanic acid, none is so valuable as *cold water*, applied to the upper part of the body in the form of a douche.[1] This is the inference to be made even from experiments on quadrupeds, whose thick hair and hide necessarily caused its effects to be less decided than they would have been in analogous degrees of poisoning in the human subject. The water is not to be applied, as some have recommended, by immersing the whole body in it, a plan which infallibly destroys whatever vitality is left, but is to be dashed upon the chest and spine at intervals, so as to excite the respiratory act, and with it renew the series of organic changes on which life depends. The first effect of this treatment, when successfully employed during the stage of paralysis or resolution, is to excite spasms of the muscles, which grow firmer, and ultimately regain their natural tone. Besides experiments on animals, numerous instances of the success of this antidote in poisoning by hydrocyanic acid[2] indicate that it is one never to be neglected. It should be at once resorted to on the discovery of the patient's condition or on the first development of the symptoms, and, along with ammonia applied to the nostrils, artificial respiration by compression of the chest, and judicious agitation of the patient, should be relied on as the chief resource against the effects of this deadliest in the catalogue of poisons.

POTASSII CYANIDUM.—Cyanide of Potassium.

Description and Properties.—This substance is obtained by subjecting a mixture of ferrocyanide of potassium and carbonate of potassium to a strong heat. Oxide of iron is precipitated, carbonic acid given off, and cyanide of potassium remains in a liquid state. When cool it is white, opaque, amorphous, and has an alkaline reaction, and the characteristic smell and taste of bitter almonds. It deliquesces rapidly on exposure to moist air.

The properties of the salt are identical with those of hydrocyanic acid, for which it may be used as a substitute. In two-grain doses it is fatal to the smaller animals. A solution of it, applied to the tongue, causes a sensation of coldness, which is followed by irritation and constriction of the fauces; and if allowed to remain long in contact with the skin, it is apt to excite a papular, or even a vesicular eruption. It may also at the same time occasion general symptoms like those of hydrocyanic acid. According to Mr.

[1] See a memoir by Dr. Herbst in Journal des Progrès, xvii. 33.
[2] Taylor, On Poisons, 2d Am. ed., p. 587.

Hornidge, it is certain that three grains are sufficient to destroy life.[1] In a case reported by Dr. C. E. Ware, of Boston, seven grains were fatal to a woman in less than an hour. Immediately on swallowing the solution she was seized with a severe burning pain in the stomach, and a feeling as if the bowels were about to act. In three or four minutes she became unconscious; there was no convulsion, but in ten minutes after the heart ceased to beat there was a sudden convulsive action of the whole body.[2] A drop of the solution upon the conjunctiva causes severe, but momentary, pain. The powder, either pure or incorporated with cerate, excites severe burning pain when applied to the skin, and, if allowed to remain, will produce an eschar.[3] Several cases are recorded of poisonous effects produced by this salt on its application to the chapped or otherwise fissured skin.[4]

Uses.—M. Trousseau states that in solution it is very efficacious, when applied to the forehead, in headaches depending on dyspepsia, and connected with imperfect menstruation, or such as are generally included under the term sick headache. The solution should contain from two to four grains of the salt in an ounce of water, and be applied on compresses.

The same solution forms a very convenient means of removing stains of nitrate of silver from the skin, which it does more quickly and thoroughly than iodide of potassium; it is also an efficient corrective of foul odors of the hands from dissection, etc. It should not be applied unless the skin is sound.

Internally this medicine may be given in the dose of one-eighth of a grain.

ACIDUM CITRICUM.—Citric Acid.

LIMONIS SUCCUS.—Lemon-Juice.

Description.—Lemon-juice is derived from the fruit of *Citrus Limonum*, a native tree of India, but naturalized in all warm climates. Besides mucilage, which disposes it to ferment, lemon-juice contains nearly two per cent. of citric acid. Its agreeably acidulous flavor is too familiar to require description. Citric acid is obtained from lemon-juice or from that of other fruits which contain it by saturating it with prepared chalk, by which means a citrate of lime is obtained, and then adding sulphuric acid, which sets the citric acid free. It is without color or smell, but has a very sour taste. Its crystals are transparent rhomboidal prisms.

[1] Times and Gaz., Jan. 1859, p. 80.

[2] Bost. Med. and Surg. Journ., Dec. 1856, p. 387.—See Hydrocyanic Acid.

[3] Trousseau and Pidoux, op. cit., ii. 144.

[4] The following cases of poisoning by this salt may be referred to: Guy's Hosp. Rep., 3d Ser. xiii. 239; Am. Journ. of Med. Sci., Jan. 1869, p. 103; Med. Record, iv. 138; Annales d'Hygiène, 2ème sér., xxix. 358; Ibid., xxxi. 484; Am. Journ. of Med. Sci., Oct. 1869, p. 408; Bull. de Thér., lxxvii. 458; Boston Med. and Surg. Journ., Jan. 1870, p. 21.

Action.—Christison and Coindet gave drachm doses of citric acid to cats without observing that the animals suffered any inconvenience therefrom, but Orfila ranks it with the irritant poisons. With half a drachm of citric acid Mitscherlich killed a rabbit in twenty minutes. One drachm did not kill a larger animal. Two drachms killed in from twenty-seven minutes to some hours. The animals showed the strong action of the poison upon the spinal cord. There was spasm of the muscles of the back, of the respiratory muscles and masseters; often opisthotonos. The sensibility was much diminished, and the heart's impulse enfeebled. On examination no inflammatory appearances were observed in the stomach and bowels. The mucous membrane was uninjected, but softened in spots. The large external veins were filled with fluid blood, and the blood flowed easily from a vein when opened. The blood itself was very thin, and coagulated slightly, if at all. These conclusions agree with those obtained by Schroff, who also states that, according to Wöhler's experiments, the acid appears to be combined with lime in the urine. This may be the case when the quantity of acid administered is small. It then, very probably, combines with salifiable bases in the alimentary canal, and is absorbed thus into the blood to be again excreted unchanged with the urine.

Dr. H. Bence Jones has shown[1] that an ounce of lemon-juice contains from twenty-seven to twenty-eight grains of citric acid and only three-quarters of a grain of potash; so that for all practical purposes it may be considered a solution of free citric acid. When given in daily doses of twelve ounces it temporarily causes an excessive acidity of the urine, and gives a deposit of free uric acid, which is the very opposite effect to that produced by the citrate of potassa and other vegetable acid salts.

The most evident physiological action of this, as of other vegetable acids, is its power of allaying thirst, which accounts for its gratefulness and real utility in all febrile affections in which this symptom is predominant. Its toxical action upon animals, including its liquefying influence upon the blood, may also afford an explanation of its advantages in disease with an excess of the fibrinous element of this fluid. But the risk of entertaining any such hypothetical notion is shown by the well-ascertained utility of citric acid and of lemon-juice in scurvy, of all diseases the one in which the coagulability of the blood is most impaired. Inflammatory and scorbutic affections agree in causing an excess of fibrin in the blood, but they differ in the power of this element to coagulate, and also in this that the red corpuscles are normal in the former, but both deficient in proportion and impaired in their structure in the latter disease. The experiments on animals referred to above, in which citric acid destroyed the coagulability of the blood, are in apparent contradiction with these well-known clinical facts; and hence it follows that the two cases of liquefaction are essentially

[1] Times and Gaz., Oct. 1854, p. 407.

different in nature. This much only is certain, that the results of direct experience in the treatment of disease cannot be shaken by those of physiological experiment either upon man or upon the lower animals.

Uses.—The most valuable application of lemon-juice and citric acid in medicine is to the prevention and cure of *scurvy*. Since the superiority of these acids in the treatment of the disease was proved by the comparative experiments and the observation of Lind, their curative and prophylactic powers in scorbutic affections have become as well settled as the virtues of cinchona in periodical diseases. It is unnecessary to cite illustrations of a proposition which there is none to dispute. The virtues of the remedy have been proved in every quarter of the world, under the equator and near the poles, on land as well as at sea. It may, however, be of interest to know that citric acid, although useful as a scorbutic, is not comparable in power to fresh or even preserved lemon-juice. In order to preserve this precious liquid for distant expeditions, Lind recommended, more than a century ago, that the orange or lemon-juice should be filtered, and then by means of a water-bath concentrated to the consistence of a syrup, and kept in well-corked bottles. He states that some lemon-juice prepared in this manner retained all its properties after the lapse of four years.[1] In 1854 the Director General of the Medical Department of the British Navy published several Reports from Arctic explorers and naval surgeons[2] confirming the established superiority of lemon-juice to all other anti-scorbutics, and proving that the best mode of preparing it is that originally recommended by Lind, with the addition of a small quantity of sweet olive oil in the neck of the bottle immediately below the cork. To maintain the efficiency of this expedient, borrowed from the common practice of stopping wine flasks in Italy, it would be necessary to keep the bottle always in an upright position.

To discuss the mode by which lemon-juice prevents and cures scurvy would, in the present state of our knowledge, be unprofitable. It may, however, be regarded as certain that the acid is not the sole nor perhaps the chief remedial agent; for on the one hand it is proved by experience that citric acid is not the equivalent of lemon-juice in this respect, and that vinegar and other acids are of comparatively slight efficacy, and, on the other, that certain fresh vegetables (*cruciferæ*), which contain little or no acid, are even more potent anti-scorbutics than lemon-juice itself.

In 1849 Dr. G. Owen Rees brought before the profession a report on the beneficial effects of lemon-juice in acute *rheumatic* affections. The sensible operation of the remedy, according to him, consists in its reducing the force and frequency of the pulse, and in securing an early relief from pain. An examination of his reported cases does not demonstrate the advantages of the treatment in shortening the attack, but in mitigating its severity the effect appeared to be

[1] A Treatise of the Scurvy, p. 207.

[2] Times and Gaz., Dec. 1854, p. 635.

favorable. Subsequently, Dr. Rees found that lemon-juice exerts no favorable influence over syphilitic and gonorrhœal rheumatism, or over that form which is found in connection with purulent discharges not necessarily gonorrhœal.[1] Its subsequent and very general employment in the treatment of rheumatism has not demonstrated its curative power, and it is now seldom employed except in the form of lemonade as a grateful drink in the more inflammatory forms of the disease. It was prescribed by Dr. Rees and others in doses of one or two ounces three or four times a day. Although generally tolerated, yet it sometimes occasions severe griping or diarrhœa.

Next to its use as an anti-scorbutic, lemon-juice is most valuable as a drink in *febrile affections* in which the thirst is urgent and the bowels are not disordered. This is usually the case in eruptive and periodical fevers. In *hemorrhages* it not only assuages thirst but directly counteracts the tendency to loss of blood. In all such cases it should be administered cool, and in the last-mentioned as cold as possible. Its diaphoretic operation is greatly promoted by administering it in the form of an *effervescing draught*, which is made as follows: Take of bicarbonate of potassa sixty grains, water four fluidounces. Make a solution, of which add a teaspoonful to a tablespoonful of lemon-juice, diluted with a tablespoonful of water, and drink during effervescence. Lemon-juice in tablespoonful doses several times a day is reputed to be a remedy for *jaundice* produced by hepatic congestion. It forms an excellent topical application in *diphtheritic angina*, in *gangrenous sore mouth* and other varieties of gangrene from constitutional causes, and has been used with striking advantage to relieve *pruritus* of the genital organs. It has been recommended as a remedy in *cancer*. Finally, it may be employed as an antidote to *alkaline* and *narcotic* poisons.

[1] Lancet, June, 1853, p. 534.

Class IX.

ARTERIAL SEDATIVES.

The pulse is regarded as one of the best indices of the state not only of the circulatory apparatus, but also of the general system, and at first sight it would seem as if its condition might be taken as a safe guide in the choice of remedies calculated to exert an influence upon the heart. But a little reflection makes it evident that this is a mistaken opinion. Morbid arterial action is not always of the same nature. An excess of the normal nutritive constituents of the blood may give the pulse a force which suggests the existence of fever, although its degree of frequency may not be proportionately great. The same effect is often produced by simple hypertrophy of the left ventricle of the heart. These are cases rather of the imminence of disease than of its actual existence. Again, in febrile affections the force and frequency of the heart's contraction are increased, in consequence, probably, of the presence and retention in the blood of an excessive proportion of some effete and morbid material arising from the disintegration of the solids. In all of these cases immoderate arterial action is the consequence of a positive redundance of normal or abnormal elements in the blood. The redundance may, however, be relative. The quantity of blood in the body may not exceed the amount required for nutrition, but, owing to a mechanical obstacle in the heart itself, such as a contraction of the mitral or the aortic valves, this organ may be forced to act with unnatural frequency in order to maintain a due supply of blood in all the organs. The same effect is produced when, instead of a mechanical obstacle impeding the passage of the blood propelled by a powerful ventricle, the ventricle itselt is feeble in consequence of dilatation, softening, fatty degeneration, etc.

But conditions the very opposite of those mentioned may occasion frequency of the pulse. The simplest type of this group is a case of sudden and profuse hemorrhage, in which the pulse becomes exceedingly frequent, and often presents a tension under the finger which cannot always be distinguished from that which accompanies inflammatory fever in a person of good constitution. The same pulse is often observed in chronic anæmia, chlorosis, and the advanced stages of chronic disorders accompanied with disorganization. In such diseases the frequency of the pulse is due, in

part, to the necessity of maintaining the strength of the body by a more rapid distribution of its imperfect nutriment, and thus compensating, by a frequent renewal of the supply, for its defective quality. It is also partly due to the excitability of the nervous system which always attends impoverishment of the blood, and is most frequently, perhaps, the immediate cause of functional palpitation of the heart.

With these facts distinctly before the mind, it seems hardly necessary to remark that it would be impossible for the same medicines in all cases to allay undue arterial action. The nature of some as plainly requires the use of depletion, evacuants, and sedatives, as that of others does the administration of stimulants, nervines, and tonics. Practically, therefore, the class of arterial sedatives might be considered as embracing all of these antagonistic medicines, and many others besides. But we have thought that two among them are so peculiar in their operation, reducing so directly the frequency of the heart's contractions when given in appropriate doses, that they are entitled to stand in a class by themselves. Digitalis and veratrum viride are the only medicines which display this power. It matters little for our present purpose whether it resides in them as an essential and primary virtue, or whether, in the case of one or both of them, it is secondary to some more general operation upon the nervous system. The question is perhaps difficult of decision; but, in regard to digitalis, the truth appears to be, that, like several of the class of diffusible stimulants, it acts as a direct sedative of irregularity of the heart depending upon debility, by giving strength, or at least temporary power, to this organ; and that, when its toxical action is developed, it renders the pulsations of the heart less frequent by an influence almost peculiar to itself and to veratrum viride, though analogous to that which in aconite is associated with powers of a different description. Veratrum viride manifests more unequivocally than its associated medicine a sedative action on the heart, and displays it without any necessarily antecedent phenomena, in states of the system decidedly sthenic, and even in fever of an inflammatory origin and type. These facts have seemed to require that the two medicines should be comprised in an independent class. No allusion is here made to the diuretic virtues of digitalis, which are perhaps more valuable than any others which belong to it, and which would rank it with squill, parsley, and broom, did it not also display its peculiar action on the heart, and through that action increase the secretion of the kidneys.

DIGITALIS.—Digitalis.

Description.—The leaves of *Digitalis purpurea*, from plants of the second year's growth. This biennial plant is a native of Europe, where it grows wild upon exposed hill-sides and riverbanks. It is also cultivated in gardens on account of its beautiful

purple flowers, which are arranged in a spike of pendulous bells, upon a stalk of from two to five feet in height. The leaves are very large, the lower ones measuring seven or eight inches in length by two or three in breadth. They are of a loose texture, and are of a deep green color upon their upper surface, but paler below. Those of the mature plant are alone suited for medicinal purposes. They lose their virtues if dried too fast or kept too long. They have a sickening and heavy odor, which probably accounts for animals refusing to browse upon them. Their virtues depend upon a peculiar principle, *digitalin*, which will be more particularly described in the sequel.

The following are officinal preparations:—

Infusum Digitalis.—*Infusion of Digitalis.*

Sixty grains of coarsely-powdered digitalis leaves are macerated for two hours in a covered vessel with half a pint of boiling water, strained, and a fluidounce of tincture of cinnamon added. The dose is from one to four fluidrachms.

Tinctura Digitalis.—*Tincture of Digitalis.*

This tincture is prepared by percolation with four ounces of digitalis and two pints of diluted alcohol. The dose is from ten to twenty drops two or three times a day.

Extractum Digitalis Fluidum.—*Fluid Extract of Digitalis.*

It is prepared like other fluid extracts; and each pint of it contains the virtues of sixteen troyounces of digitalis; or one minim represents one grain of digitalis leaves.

Extractum Digitalis.—*Extract of Digitalis.*

This extract is prepared with alcohol and diluted alcohol in the ordinary manner by percolation, and by evaporating the resulting tincture. Dose, about one-fourth of a grain.

Digitalinum.—*Digitalin.*

An aqueous solution of the alcoholic extract, acidulated with acetic acid, is digested with animal charcoal and filtered. After neutralization with ammonia, a precipitate is obtained by a solution of tannic acid in water, which is mixed with a small quantity of spirit and rubbed in a mortar with oxide of lead. The mixture is then heated, mixed with charcoal, and filtered, and the spirit having been removed by distillation, the residue is washed with ether and dried. The dose of digitalin is about one-sixtieth of a grain.

Medical History.—Fuchsius, in 1542, appears to have been the first medical author by whom this plant was described, and by him it was called digitalis, in allusion to the German name of *fingerhut*, or "thimble," an article which its bell-shaped corolla resembles. The English name, *foxglove*, has an analogous origin. In 1576, it was described by Lobelius,[1] who styles it a vulnerary. Culpepper, nearly a century later, mentions its use by the Italians as a dressing for recent wounds and old sores.[2] He recommends it as purga

[1] Hist. Stirpium, p. 305. [2] "Aralda tutte le piaghe salda," is quoted by [1]

tive, emetic, and deobstruent; as beneficial in scrofula and scalled head; and as having "been found of late to cure divers of the falling sickness that have been troubled with it above twenty years." Sir John Floyer, not long after, repeated Culpepper's statements almost literally in his *Touchstone of Medicines.* About 1711, William Salmon, a quack doctor, extolled the virtues of digitalis in his *Botanologia.* He particularly dilated on its efficacy in consumption of the lungs, affirming of it all that is usually said at the present day by the venders of specifics for incurable diseases.

About the same time, Lemery[1] described the medicine as laxative and detergent. In 1721 it was included in the *London Pharmacopœia*, but was omitted in the edition of 1746, and reinstated in that of 1788. A similar hesitation is observable in the successive editions of the *Edinburgh Pharmacopœia*, and this fact shows the apprehension with which the use of the medicine was regarded. Its final assignment to a determinate position in the Materia Medica was due to Withering, in 1775. But he was induced to make trial of it by discovering that it formed the chief ingredient in an old family receipt for dropsy, which had long been kept secret, and also by the cure of one of his friends affected with dropsy of the chest by means of another empirical prescription of the foxglove root. It would appear, indeed, to have been a popular domestic remedy for dropsy in several parts of England. In this, as in so many other cases, science was the adopter, and not the discoverer, of the therapeutic virtues of a plant.

After many attempts to isolate the active principle of digitalis, it was finally obtained in a pure state, in 1844, by Homolle and Quevenne, who entitled it *digitalin.* It occurs in pale straw-colored scales, or a white powder, and is inodorous and extremely bitter; its taste is most strongly perceived in the fauces; its smell is peculiar and faintly aromatic; it acts as a violent sternutatory when diffused through the air, and, when applied to the denuded cutis, irritates it powerfully. It is most soluble in alcohol, is neutral in its chemical relations, and combines neither with acids nor bases. It is unchangeable by exposure to the air.

Action. *On Plants.*—Marcet and Brunton have separately tried the effects of digitalis on the haricot bean by watering the plant with an infusion, and found it to kill it by withering it up. Dr. Fothergill confirmed this observation, and added confirmatory experiments of his own.[2]

On Animals.—Fothergill found that fishes placed in a weak infusion of digitalis died in lateral spasm, and after death the left ventricle of the heart was found firmly contracted. A precisely similar condition was found in birds and in frogs poisoned by digitalis. The symptoms of digitalis poisoning as observed in other animals are summarily these. The preparations of digitalis administered in large doses to dogs produce restlessness, dulness,

[1] Dict. des Drogues, 2ème éd., p. 305.
[2] Hastings Prize Essay, Lond., 1871.

slowness of the pulse, watery dejections, a staggering gait, convulsions, and death. A hen that had taken the powder of digitalis for some time, drooped, and began to shed her feathers. A turkey-hen staggered as if drunk, and voided reddish excrements, but ultimately recovered; while another grew dull, erected its feathers, and drew back its neck spasmodically. After eating the leaves for several days it refused any more; its excrements were red, its gait was tottering, it became convulsed, and ultimately, at the end of eighteen days, died very much emaciated.[1] Orfila[2] inferred from his experiments that digitalis first quickens the circulation and then retards it, rendering it, at the same time, more or less irregular; that it produces symptoms of intoxication or stupefaction, augments largely the secretion of urine, and irritates the mucous membrane of the genito-urinary passages, and, wherever applied, tends to produce inflammation.

Traube performed a number of experiments by injecting an infusion of digitalis into the jugular veins of dogs. He concluded from them that, in proper medicinal doses, digitalis is a stimulant of the circulation, and particularly of the heart, but in large or poisonous doses acts as a direct sedative of the circulatory organs, ultimately paralyzing them. He maintained, however, that the diminished frequency of the pulse is, in cases of feebleness of the heart, a proof of the stimulant operation of the medicine.[3]

Bouley and Reynal found the following, among other effects from digitalis given to horses in poisonous doses. At first hurried, then slow and interrupted breathing; the heart beat is at first more frequent and forcible, very abrupt, with a metallic tone, and later with a blowing murmur, it afterwards becomes intermittent, and the pulse is small and tense; the urine is passed abundantly, and the temperature of the body falls very low. The cardiac murmur here alluded to was probably due to the irregular contraction of the walls of the ventricles and of the muscles which move the valves.

Bouchardat and Sandras[4] found that in two grain doses *digitalin* was fatal to dogs in a period varying from a few minutes to several hours, according to the vigor of the animals. The symptoms were staggering, vomiting, diarrhœa, irregularity of the heart, and an abrupt and strong pulse, which was also rendered uniformly infrequent without having first been accelerated. Stannius[5] performed a number of experiments with digitalin on cats, dogs, etc. He concluded that in the former animals large doses of it acted directly upon the heart, destroying at once its motility and vitality. In half grain doses it was promptly fatal when thrown into the bloodvessels, and annihilated the irritability of the heart. When introduced into the stomach, or so employed as to be only gradually absorbed, the following symptoms were observed; the tongue was alternately protruded and retracted, there was retching, vomiting,

[1] WIBMER, Wirkung der Arzneimittel, etc., ii. 313.
[2] Toxicologie, ii. 566. [3] CANSTATT'S Jahresbericht, f. 1852, p. 121.
[4] Annuaire de Thérap., 1845, p. 60.
[5] CANSTATT'S Jahresb., f. 1851, p. 81; Archiv f. Phys. Heil., x. 178.

diarrhœa, and a discharge of urine, dilatation of the pupils, irregularity, and then complete arrest, of the heart's movements, convulsions, and death. Stannius observed a remarkable difference in the susceptibility of different classes of animals to digitalin. Frogs bore it well, rabbits were unaffected by a dose which was rapidly fatal to a small cat, and carnivorous animals generally were more affected than the herbivorous. In Faure's experiments[1] it was found that dogs manifested an extraordinary toleration of this substance, and that to be sure of producing characteristic effects in them it was necessary to employ from one to two grains.

On Man.—According to Boerhaave, digitalis may produce ulceration of the mouth, œsophagus, and stomach;[2] but this statement has not been confirmed by subsequent experience.

Withering's description of its effects[3] corresponds very nearly with the results of the most accurate observers since his time. According to him, when given in very large and quickly repeated doses, it occasions sickness, vomiting, sometimes a copious flow of saliva, purging, giddiness, and confused vision, objects appearing green or yellow; increased secretion of urine with frequent motions to void it, and sometimes inability to retain it; a slow pulse, even as slow as thirty-five in a minute, cold sweats, convulsions, syncope, and death. When given in smaller doses it produced most of these effects in a lower degree; and it is curious to observe, says Withering, that the sickness, with a certain dose of the medicine, does not take place for many hours after its exhibition has been discontinued; that the flow of urine will often precede, sometimes accompany, and frequently follow, the sickness at the distance of some days, and not unfrequently be checked by it. The sickness thus excited is extremely different from that occasioned by almost every other medicine; it is peculiarly distressing to the patient; it ceases and returns again as violently as before; and thus it will continue to recur for three or four days, at more and more distant intervals. These sufferings are generally rewarded by a return of appetite much greater than existed before the use of the medicine was commenced. Lettsom, who was also one of the earliest favorers of the drug, describes its general effects in the same terms as Withering, but with rather more detail.[4] According to him, the sickness it produces is very like the effects of tobacco, and resembles sea-sickness. A languor is diffused throughout the whole system; the extremities, the hands particularly, become moist and clammy, and feel cold to the touch; there is a confused aching and heaviness of the head; flashes of light frequently pass before the eyes, or almost all objects appear brilliant, and sometimes, after these symptoms pass off, the sight remains impaired for several weeks. These, and, it is believed, all of the earliest English writers on the effects of digitalis, appear to regard its influence on the pulse as being uni-

[1] Arch. Gén. de Méd., 6ème sér., iv. 413. [2] MURRAY, Apparat., i. 731.
[3] An Account of the Foxglove, etc., Birmingham, 1785, p. 184.
[4] Memoirs of the Med. Soc. of Lond., ii. 173.

formly of a depressing nature, a circumstance which may, perhaps, be ascribed to the state of disease in which the subjects of their observations were, as well as to the small and gradually increased doses of the medicine that were prescribed. An American observer, Dr. John Moore, early demonstrated the want of uniformity in the action of digitalis on the pulse.[1] By doses of one and a half grains he caused his pulse to fall from 70 to 60 in the course of two hours; from 60 to 50 in one hour and twenty minutes; from 66 to 58 in two hours and a quarter; and from 90 to 70 in about the same time. But in several other experiments there was no depression of the pulse whatever; and in others again it positively increased in frequency, while the experimenter suffered vertigo, confusion of mind, fulness of the head, drowsiness, salivation, nausea, diarrhœa, etc. The experiments of Bidault de Villiers coincide in the main with those first detailed. He also observed salivation as one of the effects of the medicine.[2]

The experiments of Saunders were, it is believed, the first to throw doubt upon the supposed intrinsically depressing powers of digitalis.[3] By more than two thousand trials of its influence upon twenty-nine healthy persons, he was led to the conclusion that the direct effect of small doses of the drug is to *increase* the strength and frequency of the pulse, and even to develop an inflammatory state of the system; yet when once these effects were produced, if the dose was augmented, or the digitalis continued at the previous dose, an astonishing slowness of the pulse and debility ensued. These results were corroborated by observations upon the sick, which showed that during the primary action of the medicine sores begin to heal, effusions are removed, and all the functions of the body are invigorated, the pulse gaining by degrees in strength and fulness until fever is excited, when the toxical phenomena display themselves, and the whole system is prostrated and deranged. About the same time Kinglake defended the same doctrine, denouncing the error of describing the diminished frequency of the pulse to debility of the heart produced by digitalis. On the contrary, he maintained, this slowness of the pulse is of the same tonic nature as that occasioned by cinchona, by opium, by wine, nutritious food, refreshing sleep, tranquillity of mind, etc. Under all these circumstances, he remarks, the pulse is not weaker, because it is slower; on the contrary, the action of the heart and arteries being strengthened, their diastole is fuller and their systole stronger. Hence it may be concluded that *digitalis in rendering the pulse slower acts as a stimulant*, and that it cures diseases due to debility by augmenting the motive power of the circulation.[4] The bold experiments of Hutchinson[5] illustrate in a striking manner the opposite actions of digitalis. They consist of three series. In the first of them 60 drops of a tincture were taken (equal to five grains

[1] Caldwell's Theses, 1800.
[2] Dict. de Méd., en 60 vol.
[3] Edinb. Med. and Surg. Journ., iv. 369.
[4] Digitalis purpurea, etc., with speculations on its modus operandi. Lond. 1801.
[5] Journ. des Progrès, vi. 218.

of the dried leaves), and the dose was repeated at intervals of six hours. Every day the quantity was increased, so that at the end of the third, it reached 380 drops for that day. The symptoms were chiefly these: nausea, vomiting, craving for food, followed by pain in the stomach, salivation, diarrhœa, increased discharge of urine, unusual activity of mind, sleeplessness, some constriction of the head, and excitement bordering on delirium. These symptoms were followed by weariness, listlessness, and almost stupor. The pulse on the first day of taking the medicine became fuller and more frequent, and rose to 100, the second day to 125, and the third to 150, after which, and coincident with the symptoms of prostration, it fell to 60. This investigation cost the experimenter an illness which confined him to bed for a fortnight, nor did he entirely recover for two months. Some time afterwards the experiments were resumed, but with smaller doses, yet by the end of a month the daily dose of 2220 drops was reached. The same general symptoms as before occurred, but the pulse, which was at 80 when the experiments began, did not rise beyond 100, and retained its strength and fulness. In walking it was faster by at least 20 beats a minute than in the recumbent posture. Within three days after the conclusion of the experiments, it fell to 60, and was readily excited. The third series of experiments lasted sixteen days, the daily dose of the medicine being gradually raised from 36 to 1300 drops. When the dose reached 219 drops, the characteristic symptoms began to appear, but now the pulse, instead of growing more frequent, fell gradually from 80 to 60, 50, 46, and at last 28. Until it reached the last-mentioned rate it continued strong and full, but at this point it became irregular and unequal.

Jörg, and his associates, observed substantially the same effects of digitalis as have been above described;[1] a milder degree of them, however, as might be expected from the much smaller doses employed, varying, in fact, from a fraction of a grain to two or three grains of the powdered leaves. The conclusions drawn from these trials were, that digitalis acts as a stimulant to the brain, producing an excitement followed by headache and dulness; that it irritates the digestive organs, causing among other symptoms, diarrhœa; that it *greatly augments the discharge of urine;* that it *excites the genital organs*, causing titillation of the glans penis, erections, and seminal emissions, and in females a sense of bearing down in the pelvis; and finally, that in healthy persons it does not produce infrequency of the pulse as a primary symptom, but only when the action of the medicine has lasted for a considerable time. Hence Jörg concludes it is an error to rank digitalis among antiphlogistic medicines.

Rasori,[2] Tommasini,[3] and others of the Italian school, have labored to prove the contro-stimulant or directly sedative action of this remedy, but not, it is conceived, with success. Nearly all of the

[1] Materialien, i. 244.
[2] Annales de Thér., iv. 405.
[3] Journ. Hebdom., vii. 33.

dropsies which Tommasini so successfully treated by its means occurred in habitual drunkards, persons the least likely in the world to be benefited by a purely sedative medicine. Chaumeton,[1] on the other hand, does not hesitate to declare that "digitalis is entitled to one of the highest places among stimulants." Hamilton,[2] too, gave unequivocal proof that the medicine is at least not merely sedative, for he found that no diuretic effect took place so long as an inflammatory condition existed; but when this was subdued by depletion, diuresis at once came on. The stimulant action of the medicine is admitted by Barbier as its primary, and sometimes its only one, but he remarks, as others have done, that sedation or slowness of the pulse generally succeeds. The same doctrine might be deduced from observations made of the use of digitalis in disease. In dropsy, for instance, nearly all writers coincide with the remark of Christison,[3] that the sedative action of the drug interferes with its diuretic effects. And this conclusion agrees with the results of experiments already set forth, which prove that diuresis not only does not follow the sedative action of digitalis on the heart as the effect of the latter, but both precedes it and is actually suspended by its occurrence. *There seems, then, to be scarcely any doubt that diuresis is a true medicinal result of the action of digitalis, while slowness and infrequency of the heart's action, when the organ is not previously diseased, is the first stage of its poisonous effects. It is, therefore, always a sign that the use of the medicine should be suspended.*

The doctrine which we have endeavored to illustrate in these pages has received a remarkable corroboration from the observations of Mr. W. Howship Dickinson on the operation of digitalis upon the *uterus*.[4] As usual, this important discovery was accidental. A female was almost exsanguine from prolonged uterine hemorrhage occasioned by a fall. Sulphuric acid, acetate of lead, and tannic acid were used in vain. An attack of pericarditis supervened, and after it the action of the heart became tumultuous, and was accompanied with "a regurgitant aortic murmur." With a vague idea that the cardiac derangement might maintain the hemorrhage, digitalis was prescribed, and immediately an improvement began which terminated in health. In sixteen cases of uterine hemorrhage the same treatment was essayed, and the digitalis was administered before and during labor when the pains were inadequate. They all demonstrated the power of the drug to excite the muscular action of the uterus. A short time, generally about ten minutes, after a considerable dose of the medicine was swallowed, the patient complained of severe pain in the region of the sacrum, which passed into the hypogastrium, and in every respect resembled the pain of the first stage of labor; very shortly afterwards a considerable quantity of blood, generally in part coagulated, was forced out of

[1] Dict. en 60 vol., art. cit.
[2] Observations on the Digitalis Purpurea. Lond., 1807.
[3] Dispensatory (Am. ed.), 447.
[4] Med.-Chir. Trans., xxxix. 1.

the uterus. A case, illustrative of the action of digitalis in arousing uterine contractions during labor, occurred in Paris under the care of M. Delpech.[1]

It is remarkable that fatal results should be comparatively infrequent from overdoses of a medicine which possesses such a control over the central organ of the circulation. When, too, it is considered how small a quantity will sometimes occasion alarming symptoms, the comparatively trivial effects of enormous doses are difficult to be explained. Thus, for example, one person took a teacupful night and morning, of a saturated infusion of digitalis;[2] another swallowed nearly the same quantity at a single dose; another took an ounce of the tincture of digitalis; and a fourth half an ounce of the same preparation.[3]

In all of these instances the symptoms were more or less alarming, but the termination was fatal in none. The dose does not seem to have been well ascertained in the published fatal cases, at least of adults. The symptoms of *fatal poisoning* by digitalis are summarily these: cramps in the limbs, convulsions, lethargy, dilated pupils; swelling of the tongue and lips, a discharge of viscid saliva, vomiting, often of a greenish liquid, which is sometimes spasmodically regurgitated; suppression of urine; a slow, infrequent, irregular, and intermitting pulse; and finally death by coma. Congestion of the brain, and redness of the mucous lining of the stomach, are the only lesions found after death from this substance. A fatal case is reported by Dr. Caussé,[4] in which a pregnant female took a poisonous dose of the fresh juice of digitalis, and, as violent vomiting, diarrhœa, and abortion followed, it is not easy to determine whether death was due to the last-named occurrence, or to the direct agency of the poison. In another case the patient, a young lady, had half an ounce of infusion of digitalis given her every four hours for the cure of epilepsy. The dose was rapidly increased until, on the fourth day, it reached two ounces every four hours. After taking the second dose, she suddenly became faint, tremulous in the limbs, said she could not see, fell back, and was dead in an instant.[5]

According to the experiments of MM. Homolle and Quevenne,[6] doses of *digitalin* varying from $\frac{1}{15}$ to $\frac{1}{11}$ gr. in the course of twenty-four hours, reduced the pulse to 55, 50, and even 40 beats a minute. The larger dose could not be exceeded without producing characteristic symptoms of poisoning. After eight or ten days' use of the medicine the pulse became unequal, irregular, and intermittent. Like digitalis, this proximate principle affected the heart differently, according to the existing state of the organ. When already irregu-

[1] Bull. de Thérap., lvi. 101.

[2] TAYLOR, Med. Jurisp. (Am. ed.), 598.

[3] BECK, Med. Jur., ii. 644.

[4] Annales d'Hygiène, Avril, 1859, p. 464.

[5] The cases published in the following places will be found peculiarly instructive: Times and Gaz., Oct. 1860, p. 417; Ibid., May, 1864, p. 590; Ibid., June, 1864, p. 658; Edinb. Med. Journ., x. 168, 171; Annales d'Hygiène, 2ème sér., xxii. 80; Arch. Gén. de Méd., Juin, 1864, p. 749; Brit. and For. Med.-Chir. Rev., April, 1865, p. 536; Bull. de Thérap., lxix. 90.

[6] Annuaire, etc., p. 71; Archives de Physiologie, Jan. 1854, pp. 248, 249.

lar, moderate doses restored its normal rhythm, while large or long-continued doses deranged the natural order of its movements. The impulse was uniformly increased by moderate doses, proving this agent to be a sedative and not a debilitant of the heart, just as was shown to be the case with digitalis. But the primary action of the latter was also proved to be that of a stimulant to the circulation, and at the same time diuretic, whereas digitalin displays its power mainly as a sedative of disordered cardiac action. The diuretic action of digitalin appears to have been but slightly manifested, as a physiological effect, either in the experiments just described or in those about to be detailed. Those of Andral and Lemaistre[1] were performed with smaller doses than have been mentioned. They began by giving about $\frac{1}{60}$ gr. of digitalin once or twice a day; but even this dose produced considerable disturbance of the system after three or four days' continuance, and when repeated five or six times within twenty-four hours, gave rise to decidedly toxical phenomena. Such, at least, was the ordinary result; but in some cases as many as twelve doses a day were taken without inconvenience. As a general rule, the pulse was more uniformly reduced in frequency (by from 12 to 40 beats), when the patient had non-febrile disease, such as an organic disease of heart, than when fever existed. The diuretic action of the medicine was not always distinct. Sometimes it was absent, but sometimes very decided, especially in dropsy connected with heart disease, or with albuminuria. The apparently feeble diuretic operation attributed by these observers to digitalin may have been due, as Dr. Christison suggests, to their regarding the sedative action of the medicine on the heart as a needful preliminary to its operation on the kidneys. But the former, instead of favoring actually interferes with and may even suspend the latter. The interesting observations of M. Hervieux lead substantially to the same results as have been here set forth.[2] Like other observers, he found that the medicine caused irregularity in the normal pulse, but restored the irregular pulse to a healthy rhythm. The experiments of Bouchardat and Sandras so nearly coincide in their results with those already cited, as to render a summary of them unnecessary.[3]

The more recent researches into the operation of digitalis have confirmed the general views respecting it which have been inculcated. It will have been remarked that the statements in regard to its diuretic virtues are very inharmonious. But assertions like those of Jörg, that digitalis augments the discharge of urine, as a physiological operation, are now proved to be utterly untrustworthy. Among recent experimenters, Bähr is the only one that repeats the old fallacy, but his own recorded experiments convict him of error by showing that the increase of urine was in exact proportion to the increased quantity of liquids consumed. Germain, Winogradoff, Pfaff, and Stadion, all failed to observe the

[1] Am. Journ. of Med. Sci., Jan. 1853, p. 192.
[2] Archives Gén., 4ème sér., xvii. 164.
[3] Loc. sup. cit.

slightest diuresis produced by digitalin in the healthy state; on the other hand, they, as well as Dr. Hammond, found that it lessens the proportion of all the solids in the urine except uric acid, and hence lowers its specific gravity, while diminishing the amount of urine secreted.

Stadion, in his experiments upon himself,[1] began with doses of digitalin of two milligrames a day ($\frac{1}{33}$ gr.), and daily increased the dose by one milligramme, so that on the nineteenth day he took about one-third of a grain. During the whole period of his experiments he used 189 milligrammes, or three grains. In his observations upon the pulse he took the precaution to count it before rising in the morning, and consequently before it could be influenced by external causes. During the first eight days it rose from 50–51 to 52–55, and then gradually declined to 46–44. It does not follow that the pulse-rate may not be directly diminished by large doses of the medicine, as many observers have alleged it to be. All are, moreover, agreed that the slower action of the pulse is attended with an increase of its fulness and force. Stadion at the same time noted its increased irritability, so that slight muscular or other excitement quickened its rate perceptibly. He also experienced paroxysmal distress in the præcordial region, which he compared to rheumatic pains, and attributed to an action of the medicine upon the nerves.

The special mode of action exerted by digitalis upon the heart has already been stated to be probably of a tonic, and not of a debilitating nature. Experiments made with digitalin confirm this opinion. Among others, Dr. C. Handfield Jones found that in animals poisoned by digitalis, the heart, after death, was firmly contracted, a condition, he remarks, more like tonic spasm than paralysis; and he refers to Traube's dynamometrical experiments to show that a heavier column of blood is raised by an animal's heart under the influence of digitalis than without it. But it must be acknowledged that these experiments only prove the persistence of the muscular contractility; they do not demonstrate the preservation or increase of that other power, analogous to the voluntary contraction of muscles of animal life, by which the rhythmical movements of the heart are maintained. In this connection it may not be uninteresting to state that Dybkovsky and Pelikan having used, in experiments upon frogs, upas poison, extract of Tanghinia venenifera, veratrum viride, and digitalis; the heart was in every case found strongly contracted; yet these observers regard the phenomena in question as an effect of *paralysis* of the heart, and they class the four substances used in their experiments together in one group as "cardiac poisons."[2] It is evident, therefore, that the increased power of the heart under the influence of digitalis is not indentical with that which it acquires from the use of diffusible stimuli or hematic tonics, but, on the contrary, may coexist with a really impaired muscular energy.

[1] Prager Vierteljahrs., lxxiv. 97.
[2] Ibid., lxxviii. Anal. 20.

Since the third edition of this work was issued, in 1868, numerous experimental and critical essays have been published respecting the mode of operation of digitalis and digitalin, by Botkin, Brunton, Fothergill, Lorain, Boehm, Traube, Ackermann, and many others, and although they render somewhat more precise our knowledge of the subject, they do not essentially or radically change the doctrine which we have maintained on previous occasions. They prove that in moderate doses digitalis increases the circulatory power of the heart, but not its circulatory capacity, since the action of the medicine is to produce a tonic contraction of the heart, which is chiefly exhibited in its left ventricle. So long as this contraction is maintained within certain limits, it does no harm in health, and in certain diseases of the heart, involving positive or relative debility of the organ, may neutralize the disorders dependent upon such diseases; but if such linits are exceeded, the tonic contraction of the heart presents an obstacle to the circulation, and generally leads to death by arrest of the heart's action (syncope). It seems, also, to be pretty well established that digitalis and its preparations possess no diuretic virtues in the normal state of the system. It is to be regretted that the numerous and ingenious investigations that have been referred to should have confused the subject by mingling with experimental and clinical results the views of the authors upon nerve physiology in such a manner that it becomes very difficult to separate material facts from the more or less firmly established doctrines of the day respecting the powers which maintain and regulate the circulation of the blood. However interesting the speculations of accomplished investigators may be upon subjects such as these, they possess only a secondary and subordinate interest for the physician, and have a tendency to confuse his conception of the practical value of this and other medicines, which, after all, is the only portion of the subject that concerns us here.

The above doctrine derives support from the condition of other apparatus than the circulatory, while the latter may seem to be gaining in tone and power. In Stadion's experiments with digitalin, as in those with digitalis already referred to, the appetite failed, there was nausea and *malaise*, a disagreeable and pasty taste in the mouth, loss of appetite, and aversion to food. These symptoms were followed by an almost irrepressible desire to vomit. The head was oppressed and painful, and the mind confused. Giddiness and somnolence occurred in the last days of the experiment, and persisted for several days after its close. Frequent scintillations rendered vision imperfect. An extreme and indescribable debility affected the limbs; the hands and feet felt as if weighted with lead, and there was an irresistible desire to keep perfectly still. There was, moreover, a rapid loss of flesh, not to be explained by the excreta, for there was nether vomiting, diarrhœa, nor diuresis. As emaciation proceeded, the countenance acquired a color and expression which Stadion compared to that which is observed in the forming stage of typhoid and eruptive fevers. It

continued for a week even after the use of the medicine had been suspended.

It has been seen above that Jörg enumerates excitation of the genital organs among the phenomena produced by digitalis. Directly the opposite effect from digitalis has been recorded by several competent observers. Many years ago[1] L. Corvisart reported several instances of its success in curing seminal emissions, which he attributed to its sedative tonic influence upon morbidly stimulated organs. But Brughmans found that it prevented erections and their consequences produced by gonorrhœal and syphilitic inflammation in persons who were otherwise healthy, and also determined that it totally annihilated sexual desire in persons free from venereal and all other disease.[2] The former conclusion was also confirmed by Laroche.[3] According to Pfaff, digitalis primarily depresses and afterwards stimulates the sexual organs,[4] an opinion in which he stands alone. Stadion, who took much larger doses of digitalin, fully sustains the correctness of Brughmans' observations. During the whole period of time devoted to his experiments sexual desire seemed extinct, and after their completion it resumed its wonted activity very gradually. Dr. Brunton also found that it "annuls the activity of the genital organs."

Several cases of poisoning by digitalin are on record. In one of these a robust female took sixteen granules (nearly a quarter of a grain) of digitalin. Two hours passed without sensible effects, and then she was attacked with a nervous chill and vertigo. For nine hours more nothing remarkable occurred, but then the rigor was renewed, with dyspnœa and sweating. After a night's sleep all of the symptoms had disappeared. She then swallowed forty granules more, and in an hour was seized with disorder of vision, vertigo, cold sweating, vomiting, and colic, after which she became extremely faint. Neither urine nor fæces were passed during the day, and the voice became very feeble. The thirst was urgent, the urine suppressed, the eyes very prominent, the skin cold, the pulse 46, and the epigastrium tender. In a week she had entirely recovered.[5]

It seems to be an inevitable conclusion from the preceding statement of the phenomena caused by digitalis and its preparations, that the primary action of the medicine in ordinary doses is not depressing, as it is generally stated to be; that, on the contrary, it is a stimulant of the healthy system, and a moderator of morbid action depending upon general or local disease. When taken in excessive or poisonous doses, it appears with equal clearness to be a direct sedative, paralyzing the heart and nervous system, and so destroying life. This double action it shares with a great number of medicines, and, among those affecting the nervous system, with none more strikingly than with opium. Finally, it may be stated,

[1] Bull. de Thérap., 1853, xliv. 145.
[2] Ibid., xlv. 424.
[3] Ibid., xlvi. 76.
[4] Ibid., lx. 100.
[5] Annuaire de Thérap., 1858, p. 102.

as a part of the experimental history of the drug, that, according to Homolle, digitalin is altogether destitute of the nauseating and emetic properties of digitalis, while it represents the diuretic virtues of the medicine and its sedative operation upon the heart.[1] The account which has been given above of the action of the plant and of its representative principle, does not permit us to accept so absolute a conclusion. At the same time, it proves the superiority of digitalin in the mildness, safety, and certainty of its operation.

Remedial Employment. *Dropsy.*—Although digitalis is not a direct diuretic, it is none the less a most powerful agent for the production of diuresis in certain conditions of which dropsy is a symptom. The remedial virtues of digitalis have been more clearly exhibited in this than in any other disease, and it had long been applied empirically to their cure before it was adopted into the materia medica. It was for his success in treating dropsical affections with digitalis that the name of Withering will always occupy the most conspicuous place in its early history. To this day, even, his precepts in regard to its administration continue to be the safest guide for those who employ it. "I use it," says this author,[2] "in ascites, anasarca, and hydrops pectoris, and, so far as the removal of the water will contribute to cure the patients, it will cure them. Hence the water has often to be repeatedly evacuated in the same patient when the cause of the dropsy remains." In the anasarca following scarlatina, Withering cured all of the cases, without exception, that he had to treat. It resulted from his experience that if the patient be of great natural strength, a warm skin, and florid complexion, and with a tense, corded pulse, or if the effusion itself be hard and circumscribed, or the anasarcous limbs be solid and resisting, digitalis will be of little, if any, service, particularly if purging by the neutral salts, venesection, and squills do not precede and accompany the use of the former medicine. If, on the other hand, the pulse be feeble, the countenance pale, the lips livid, the skin cold, the belly soft and fluctuating, and the limbs readily pitting on pressure, the diuretic action of the medicine is generally successful. These conclusions perfectly accord with the modern opinions respecting the tonic action of digitalis on the heart.

Some additional indications were enumerated by Darwin.[3] He regarded the medicine as being most successful when the patients were past the meridian of life, and accustomed to indulge too freely in fermented or spirituous liquors. Many of his own were subject to gout, and many had œdematous swellings of the thighs and legs, dyspnœa, and an unequal pulse, signs which render it highly probable that they were affected with valvular disease of the heart. This is the more probable, because in many cases the effusion recurred, and was removed again by the same treatment, and because the pulse continued to be irregular after the dropsy was cured. Darwin always suspended the medicine on the occurrence of sick-

[1] Arch. Gén., Juill. 1861, p. 25.
[2] Op. cit., p. 6 et seq., and p. 189.
[3] Trans. Lond. Coll. Phys., iii. 255.

ness of the stomach; he also conjoined it with bark and iron in his treatment, and directed laxatives if the bowels were not freely opened. In dropsy confined to the abdomen, he, in common with most other physicians, found the remedy least successful; but cases of this variety were most readily relieved when the subjects of them were addicted to the intemperate use of alcoholic and fermented drinks.

Lettsom, in his first publication upon the subject,[1] was disposed to limit the usefulness of digitalis much more than the writers just referred to, excluding from the category to which it is applicable all cases depending exclusively upon a mechanical or organic cause. Withering, however, complained that the medicine had not been properly administered by Dr. L., who, in fact, was led subsequently to form a more favorable judgment of its powers, and particularly to guard against its depressing effects by a more prudent regulation of its doses, and by associating it with tonics and stimulants. Ferriar did not conceive so high an opinion of this medicine in dropsy,[2] but asserted his persuasion that when given in such quantities as to alter the pulse, if it does not speedily act as a hydragogue or a diuretic, it is merely loss of time to persevere in its exhibition. He agrees, however, with Withering in regard to the cases which it chiefly benefits, and states that he has seen all the symptoms of general dropsy, attended with a fluttering and feeble pulse, removed by digitalis in the course of a week. He particularly recommends its association with calomel and Dover's powder, a combination which even now is oftener used for dropsy than digitalis alone. Saunders regarded simple debility or exhaustion, without organic complication, as affording the best indication for the use of digitalis in dropsy.[3] McClean, in his work on hydrothorax, expresses his agreement with the precept of the earlier writers on the subject under discussion, by alleging the peculiar efficacy of the medicine in persons of weak and lax fibre, where the œdematous limbs readily pit on pressure, and the complexion is pale and transparent. Blackall subscribes to the same doctrine, and Munk emphatically reiterates it.[4] The former, indeed, specifies more particularly the appropriate cases for the medicine as being general dropsy after scarlatina, with coagulable urine, and sometimes even hydrocephalus from that cause. In hydrothorax he regards the power of digitalis as astonishing, and the more so when its combination with other remedies is avoided. Theoretical objections of two kinds, to the use of digitalis in dropsy of renal origin, have been proposed. Long ago it was argued that the renal disease being of an inflammatory nature, diuretics must necessarily aggravate it because they must irritate the kidney. Now, being considered a diuretic in the only sense then understood, digitalis was held to be a dangerous stimulant of the kidney. It is true that the rigor of this condemnation was modified by the judgment

[1] Mem. Med. Soc. Lond., ii. 145.
[2] Med. Histories (Am. ed.), p. 271.
[3] Med. Repos., xv. 403.
[4] Op. inf. cit.

of authoritative physicians. Thus Bright, to some extent, sanctioned the use of digitalis, saying, "It has in some instances been cautiously administered with temporary advantage, and seems by its power of checking the circulation to be well adapted to those cases where the pulse is sharp, as frequently occurs throughout the whole progress of the disease."[1] Digitalis and cream of tartar were recommended by Dr. Bright, and the same combination was employed by Dr. Christison, who mentioned the difficulty he experienced in obtaining a diuretic operation from digitalis alone, although he used it to sustain the action of the combination when once it had commenced.[2] Dr. Miller, in his Essay on Pathology of the Kidney in Scarlatina, objects to the prescription of digitalis in the dropsy resulting from that disease, on the ground that it occasions asthenia. Dr. Reese remarks that "the diuretic action of this drug is not of a stimulant kind," and states that "when discreetly exhibited there is much apparent benefit from its use." The dose, however, should be small, and its effects on the pulse narrowly watched.[3] Dr. Todd affirms that digitalis, *with due precaution*, is very useful in acute renal dropsy; and advises it in conjunction with tonics and iron in dropsy from cardiac disease. In all of these cases the dread of treating an asthenic disease by a medicine assumed to be a direct sedative, appears to have prevented its real action and curative value from being ascertained. Thus theory perpetually hinders the progress of therapeutics! Withering, it has been seen, cured scarlatinous and cardiac dropsy without greatly concerning himself with the question of its mode of operation; it was only when assumed notions of its action controlled its use that its advantages were called in question. If, however, it be true, as already stated, that no evidence of its irritant action upon the kidney exists, the medicine may be restored to its former use in dropsy with albuminous urine, upon grounds which will appease scientific objectors as well as justify practical physicians.

The other objection referred to is founded upon the fact stated elsewhere, that under the influence of digitalis the elimination of effete organic matter by the kidneys is diminished. It is argued, therefore, that the medicine favors the occurrence of those toxæmic phenomena which so frequently attend the advanced stages of Bright's disease, and may even add to them its own poisonous sedation. So far as we are aware, no record exists of any such evil consequences from the administration of digitalis at any stage of the affection; and therefore it is needless to discuss the possibilities of their occurrence. The organic condition of the kidneys may, and, at some stages of the disease, must preclude all hope of evacuating the dropsical fluid through these organs; but experience accords with reason in teaching that a moderate use of digitalis forms a useful element of the treatment by which dropsical effusions may be diminished even in granular degeneration of the kidneys.

[1] Reports, etc., p. 73.
[2] On Granular Degeneration of the Kidneys, Sect. vi.
[3] Diseases of the Kidney connected with Albuminous Urine.

Among more recent authorities, the judicious Dr. Holland adds the weight of his testimony to the general principle which we have endeavored to inculcate;[1] for, after pointing out the fact that there are many cases of dropsy in which a combined tonic and evacuant treatment is indicated, he states that in such he has found iron associated with digitalis eminently serviceable. Dropsy accompanied with dilatation and irregularity of the heart appeared to be remarkably improved by the medicine, and particularly thoracic and abdominal effusions. He agrees, too, with the opinion of the chief authorities now quoted, that the medicine is most efficient when the circulation is feeble and the fibre relaxed. It adds to the force of the considerations already presented on the subject to state that, according to Dr. Holland's experience, patients who have been weakened by disease often bear much larger doses than those in sounder health.

Among American authorities, Rush[2] and Mease,[3] who flourished soon after the general introduction of the remedy into European practice, both speak disparagingly of it. The former, indeed, found it to fail in most of the cases for which he prescribed it. Dr. Chapman, however, confirms the most favorable judgment of digitalis by his own experience. He directs attention to its sometimes producing diuresis suddenly, and simultaneously with its secondary or sedative effects, a circumstance which is not in harmony with the observation of others. At the same time, he correctly regards a low and enfeebled condition of the constitution as the most propitious for its exhibition.

The virtues of digitalis in dropsy have occasionally been manifested by its external application. Belluci reported five cases of the cure of *hydrocele* by the application of an ointment of digitalis to the scrotum, and Lafargue has confirmed them by a case in his own practice. He made use of an ointment containing one part of digitalis to five of lard.[4] M. Falot, also, cured three cases of *ascites*, independent of organic disease, by means of fomentations made with two ounces of digitalis in a quart of water boiled down to a pint. Copious diuresis was produced, and the cure followed.[5]

There is no doubt of the powerful diuretic virtues of *digitalin* in *dropsical diseases*. In a case of anasarca following labor, and complicated with pericarditis and hæmaturia, it quickly produced a copious flow of urine, and the patient recovered.[6] Several cases are related by M. Hervieux of dropsy accompanying valvular disease of the heart. Some of them were extremely aggravated by reason of the degree of cardiac derangement; but under the use of digitalin the breathing grew less anxious, or even became quite natural; habitual congestion of the face and head, with the accompanying headache, disappeared, and the patients were enabled to sleep quietly. At the same time, in all but very old and extreme

[1] Notes and Reflections (Am. ed.), p. 332.
[2] Works, ii. 110.
[3] Med. Repert., i. 145.
[4] Bull de Thérap., xlvii. 444.
[5] Lancet, May, 1853, p. 428.
[6] HOMOLLE, etc.

cases, the dropsy was entirely removed, as well in those depending upon cardiac disease as in other cases.

Dr. Christison has remarked that the diuretic action of digitalin is never accompanied with albuminuria, and that sometimes, when albumen previously exists in the urine, it disappears, at least temporarily, under the influence of the medicine.[1]

The proofs of the efficacy of digitalis and its active principles in the cure of dropsy might be much further extended, but the preceding are sufficient to illustrate the nature and the limits of its power. They harmonize with the results of experiments on healthy persons, and strengthen materially the conviction which these create of the stimulant, and even tonic, properties of moderate doses of digitalis when administered to persons suffering from loss of power and tone. *In dropsy, of whatever form, debility is the morbid element which calls for the exhibition of digitalis;* and, with this qualification, the statement may be accepted that it is of all diuretics the most certain, and when it fails in dropsy there is little to hope from any other means.

Diseases of the Heart.—Former writers upon this class of diseases endeavored to determine with precision the particular cases to which digitalis is appropriate, and those in which it acts injuriously. They, in general, arranged in the former class hypertrophy of the left ventricle, and in the latter dilatation of either the right or left cavities. This doctrine did not, however, rest upon observation, but flowed rather from a perfectly gratuitous hypothesis concerning the action of digitalis; the doctrine, namely, that it is a direct sedative, debilitating the heart and at the same time reducing the number of its pulsations. But this explanation is altogether opposed to the numerous facts which show that the tendency of digitalis is rather to increase the energy of the heart's pulsations than to weaken them, even when their frequency is very much lessened under the influence of the medicine. The mere anatomical condition of the heart is a much less trustworthy guide to the use of digitalis than the alterations of its power and rhythm. When its action is irregular, tumultuous, and excessive, and the breathing panting or oppressed, and when, at the same time, the patient's condition is one of debility or exhaustion, digitalis may generally be used with advantage. But when such derangement of the heart and of the breathing occurs in a person of full habit and unimpaired muscular strength, the use of the remedy ought to be preceded by depletion, diet, or purging. There is one form of the heart-disease, however, in which it seems probable that the full action of digitalis must be injurious, to wit, contraction, and patency of the aortic valves. Dr. Corrigan and several other writers have insisted upon this proposition. In numerous cases reported by them the symptoms appear to have been severely, and even seriously, aggravated by the medicine in sedative doses; the breathing was rendered more laborious, and the cough more urgent.

[1] Month. Journ. of Med. Sci., Jan. 1855, p. 3.

It is not difficult to account for this effect. The disease becomes a cause of distress because the blood regurgitates through the aortic orifice into the ventricle; hence it seems but reasonable to suppose that whatever causes the heart to beat more slowly must allow the blood to flow back more freely into the ventricle, to distend it unduly, to paralyze it, and consequently to interrupt the circulation and the breathing. The natural mode of relief for the symptoms which this disease occasions is the frequent and free contraction of the ventricle; but digitalis, unless cautiously administered, renders its contractions less instead of more frequent, and therefore aggravates the evil instead of palliating it. Dr. Walshe states that digitalis may be used during the gravest attacks of quasi-syncopal palpitation, and even where the dominant valvular defect is aortic reflux. "But," he continues, "I hasten to add, that I have actually seen this only in cases where other cardiac mischiefs were associated with the aortic, and where, consequently, as I have been led to judge, the danger of instantaneous death is less than in simple deficiency. On the other hand, there is no doubt digitalis is more useful, as a rule, where the defect is more mitral than aortic."[1] Dr. Balfour, also, upon this subject, says: "In cases of aortic regurgitation the greatest benefit may be derived from its administration, not because the heart's action is slowed, but because it is strengthened and steadied, the very result that is sought for in such cases."[2] Dr. B. W. Foster has clearly set forth the relations of digitalis to the several forms of valvular heart disease; as regards aortic insufficiency he says: "The low arterial tension may require increasing, the heart's strength want reinforcing, but these two indications cannot be fulfilled by any remedy which, like digitalis, adds to the prime evil. The more forcibly the heart beats, and the greater the arterial tension, the greater, *cæteris paribus*, will be the reflux through the imperfect valves; and while the valvular lesion remains a constant quantity, digitalis will multiply its effects by increasing the period of its action." And in regard to aortic obstruction, he remarks, that in this case the hypertropy and dilatation of the left ventricle furnish at once the simplest and the most perfect of any of the forms of compensation. Digitalis can do little for such cases, because there is little good to do so long as the cardiac muscles are well nourished; and, when they cease to be healthy, digitalis is worse than useless. And even when, as the case usually is, mitral insufficiency or obstruction exists, or both together are present, the utility of digitalis, or even its tolerance, will depend upon the predominance of the mitral over the aortic lesion.[3]

The conclusions of Dr. Munk[4] are not, in any essential point, at variance with the principles which have been here maintained. According to him, digitalis is seldom as advantageous in simple

[1] Dis. of the Heart, etc., 4th ed., p. 404. [2] Edinb. Med. Journ., xv. 743.
[3] Brit. and For. Med.-Chir. Rev., July, 1871, p. 214.
[4] BRAITHWAITE's Retrospect, x. 60.

hypertrophy as when it is combined with other lesions of the organ, because the condition of tone contraindicates its employment, although the heart at the same time beat tumultuously. But in dilatation, with valvular disease of the organ and dropsy, it is of great utility by its indirect sedative and diuretic influence. In a plethoric state of the system, he agrees with many other authorities that it is inoperative. Trousseau and Pidoux, on the other hand, recommend the medicine in hypertrophy, whether accompanied with dilatation or not, and disapprove of its use in simple dilatation, with signs of impeded circulation, such as coldness and œdema of the extremities, congestion of the face, etc. But this opinion is opposed to all experience, and rests upon the conjectural interpretation, as well of the action of the medicine as of the mechanism of diseases of the heart, which was before referred to. Dr. Holland confirms the view which we have taken of the true indications for the use of digitalis in heart disease. He can find nothing incredible in the fact that it may under certain circumstances tend to produce intermittent pulsation, and yet under other circumstances correct the irregularity already existing. He points out the fact, which must now be regarded as established, that the large and flaccid heart is not, as on first view it might seem, the least favorable to the use of the medicine. And he aptly compares the action of digitalis on an irregular heart to that of fever, which often restores a natural rhythm to a deranged pulse; thus implying his belief in the stimulant properties of the medicine. Conclusions almost identical with the preceding have been drawn by M. Beau from his clinical experience. He shows that, in organic disease of the heart, congestion of the face and of the jugular veins, puffiness of the eyelids, smallness of the pulse, dyspnœa, palpitation, and dropsy are symptoms produced by a want of power in the ventricles, and that in such disease, if the pulse is frequent, its frequency is merely a sign of the struggles of the heart to compensate for the small amount of blood which it distributes, by the iteration of its contractions.[1] If, then, digitalis does—as we know that it really does—dissipate all these symptoms while it lowers the pulse, its action upon the heart must necessarily be that of a stimulant.

It is unnecessary to add new arguments to those now adduced in regard to the action of digitalis as a cardiac tonic, but it may be stated that prolonged experience confirms the justness of the doctrine. The current records of medical observation abound in proofs of its efficacy in the class of cases that have been described, and Dr. Fuller, whose authority in such questions as this will not be questioned, says: Digitalis "is a most valuable remedy in the treatment of dilatation, and is dangerous only when administered in hypertrophy. . . . . By stimulating the muscular tissue of the heart, it allays the irritability of that organ and moderates its action, whilst it augments the tone and contractility of the vessels, increases the flow of urine, and exerts a restorative and calming

[1] Abeille Méd., xiii. 33.

influence over the system which is not attainable by any other means."[1] The same principle operates in the successful treatment of mitral disease connected with dropsy. The dropsy is directly due to congestion of the kidneys, and remotely to the stasis of the blood throughout the venous system caused by mitral obstruction. When digitalis moderates the tumult of the heart and increases the heart's tone, it restores the balance of the circulation, relieves the congested kidneys, and permits their secretion to take place freely. A few years ago it might have excited surprise that iron and strychnia should be administered conjointly with digitalis; but it is now settled that these medicines, in appropriate doses, combine harmoniously to strengthen the enfeebled heart, not only when this organ is the primary seat of debility, but when it shares in the exhaustion produced by various chronic diseases, and especially by those in which anæmia and loss of appetite are conspicuous symptoms.[2]

Fevers.—Cases of *puerperal fever* have been reported in which the patients recovered after experiencing decidedly the sedative influence of digitalis upon the pulse;[3] and in *typhoid fever* Wunderlich found that it diminished the fever, lowered the pulse, and moderated the entire course of the disease, when an infusion of fifteen or twenty grains was administered daily in divided doses.[4] Subsequent observations by various physicians seem to demonstrate very clearly that the course of typhoid fever is not abridged by digitalis, nor is any one of its more important symptoms, nor is its issue, favorably influenced by the medicine.[5]

Inflammations.—At one time a great deal was written about the antiphlogistic power of digitalis, and especially by disciples of the Rasorian school. The founder of this sect was warmly eloquent in favor of the marvellous powers of the medicine in diseases of a purely inflammatory type, and especially in those of the chest. Published reports show that his patients recovered after he had prescribed for them from ten to thirty grains of digitalis a day in the treatment of pneumonia, pleurisy, bronchitis, etc., and they must therefore be regarded as demonstrating the impunity with which large doses of it may be administered; but they afford no evidence of its curative powers in diseases which seldom require active treatment for their cure. It is unnecessary to cite the favorable opinions which have been uttered and reiterated respecting the virtues of digitalis as a remedy for inflammation. They

[1] On Diseases of the Chest (1862), p. 592.

[2] It is unnecessary to burden the text with additional evidence in support of the doctrine which is there advocated; continued observation only deepens the impression of its soundness. They who desire additional proof may find it in STERLING, Times and Gaz., March, 1864, p. 251; MURRAY, Ibid., March, 1865, p. 277; Ibid., July, 1865, p. 114; MACKEY, Braithwaite's Retros., lviii. 269; C. H. JONES, Trans. Clin. Soc., i. 148; FOTHERGILL, Edinb. Journ., xlv. 876; BUCQUOY, Bull. de Thérap., lxxvi. 535; NIEMEYER, Pract. Med., i. 315; JACCOUD, Practitioner, vii. 245.

[3] Am. Med. Times, Sept. 1860, pp. 204, 223.

[4] Arch. der Heilkunde, iii. 97.

[5] Comp. HANKEL, Arch. der Heilkunde, 1869.

are almost entirely unsupported by direct evidence, or even by analogical proof. If the arachnitis of children, which is said to be signally benefited by the medicine, form an apparent exception to the remark, the origin of this affection in tuberculous deposits, its slow and gradual progress, and the merely incidental character of its inflammatory symptoms, destroy its claim to be regarded as really an exception to the general statement that has been made.

Hemorrhage is another affection to which digitalis seems to have been applied also upon theoretical grounds. Instances are cited by Ferriar, Jones, Richter, Burns, and others, of its controlling influence upon hemorrhagic attacks. But it is a familiar fact that in cases of hæmoptysis and hæmatemesis the bleeding almost always ceases spontaneously, provided that the patient remain perfectly quiet and in a proper position. Uterine hemorrhage, it is true, is not so apt to cease promptly, and until the discovery of Mr. Dickinson there was no sufficient proof that digitalis is capable of arresting it. This gentleman states that during a certain period he had treated all of his patients suffering from *menorrhagia*, and who required medical interference, with digitalis alone. The discharge was invariably arrested from the second to the fourth day, according to the strength of the dose administered. These statements are fully confirmed by the observations of Dr. Barclay and of Trousseau. Even in uterine hemorrhage depending upon organic disease, the influence of the medicine was distinctly marked, though necessarily less permanent.[1] M. Decaisne has furnished an example of fungous growths in the uterine cavity occasioning profuse hemorrhage at the menstrual periods, which appeared to be entirely controlled by the use of digitalin, in the daily dose of six granules.[2]

Pulmonary Affections.—The practitioners of half a century ago, and even less, were profuse in their eulogies of digitalis as a cure of pulmonary affections, including consumption. Beddoes went so far as to say, " Were I to affirm that it cures three out of five cases of consumption, I think I should keep within the limits of truth." Dr. Hosack took a diametrically opposite, and a much truer, view of the subject, when he said of its indiscriminate use in this disease, " Digitalis is a finger which points to the grave."[3] It may have been useful in certain chronic catarrhs of the lungs which would have been as readily cured by other means; and this forms the whole basis of a reputation which the physical methods of diagnosis effectually destroyed. There is, indeed, reason to believe that it was of service in the class of affections referred to. One even of the latest authorities, Neumann, asserts it to be, if not the only, yet decidedly one of the best remedies in bronchorrhœa. When the reports of its earliest favorers are closely scrutinized, nothing can be clearer than the conclusion that they were deceived, and that those who now interpret their language literally contribute to deceive readers of the present day. The cases of Kinglake,[4] in which

[1] Med.-Chir. Trans., xxxix. 8.
[2] Bull. de Thérap., lvi. 392.
[3] Pract. Med., p. 582.
[4] BAYLE, Bibl. de Thérap., iii. 266.

any benefit was derived from the medicine, were plainly examples of chronic bronchitis and chronic pleurisy; those of Fowler were of the same character precisely; and a like judgment must be pronounced on the reports of Beddoes and Drake. To give only one, but a conclusive, proof, among those which an analysis of the cases in question furnishes, of the non-tubercular character of the affections reported to have been cured, it may be remarked that in but two or three among them all is any mention made of hæmoptysis, the capital and least equivocal of the general signs of tubercular phthisis in the male sex. Besides, McLean expressly states that of the patients treated some had "genuine phthisis, whose fatal course it is impossible to arrest," but the remainder were suffering from the consequences of neglected or ill-treated catarrhs.

It has been found that several of the most distressing symptoms of phthisis are amended by digitalin. The breathing becomes freer, and the headache less severe; the cough is palliated; the sleep is less disturbed, and the whole condition of the patient is ameliorated.

However erroneous the ideas which some physicians entertained of the curability of tubercular consumption by digitalis, the reports now referred to furnish unquestionable evidence of its utility in chronic bronchitis attended with fever of a hectic type, œdema of the limbs, and emaciation. They leave no doubt of its value in moderating the morbid excitement of the system, reducing the pulse, allaying the cough, and lessening the perspiration, and in this manner preparing the way for a thorough cure by appropriate tonic medicines and hygienic observances.

In 1853, M. L. Corvisart, having observed that a patient subject to *spermatorrhœa*, who was taking digitalin for nervous palpitations of the heart, was entirely freed from his infirmity while under the influence of the medicine, employed it in two other cases of the same affection, with complete success. The dose prescribed in each was a granule, containing $\frac{1}{60}$ gr., twice a day.[1] Subsequently M. Brughmans reported five cases demonstrating the efficacy of digitalis in this complaint, and in others requiring a state of repose in the virile organ, such as gonorrhœa, chancre, and other primary venereal symptoms. According to him, it dissipates the swelling of the glans penis, of the prepuce, the urethra, the prostate, and the vesiculæ seminales, with "a certainty unparalleled in the effects of other therapeutic agents." He directed six or eight grains of digitalis to be given daily in divided doses.[2] A young man had suffered for twenty days with nocturnal seminal emissions, and his strength was completely exhausted; M. Laroche prescribed three granules of digitalin, and the following night the pollutions intermitted for the first time.[3] The anaphrodisiac virtues of digitalin, it has already been mentioned, were proved by the experiments of Brughmans and of Stadion.

[1] Bull. de Thérap., xiv. 145. [2] Ibid., xiv. 424.
[3] Times and Gaz., Nov. 1854, p. 473.

Delirium Tremens.—The doctrine of the tonic action of medicinal doses of digitalis, which is maintained in this article, is confirmed by the results of its use in delirium tremens. So far as we can discover, it was first used in the treatment of this disease by Dr. Pierson, of Salem, Massachusetts, in imitation of whose practice, Dr. Webster administered two doses of sixty drops each at an interval of six hours. Shortly after the second dose was taken, the patient exhibited a considerable degree of languor, and became more composed; the violence of his muscular efforts abated, and towards morning he fell asleep, after which he speedily recovered.[1] Many years afterwards (1836) Dr. Cless, of Wurtemberg, treated thirteen cases of delirium tremens with a strong infusion of digitalis in doses of a spoonful every two hours. "After symptoms of narcotism have made their appearance," he says, "recovery ensues."[2] These, and perhaps many equally favorable results, do not appear to have overcome the foregone conclusion of medical authorities that digitalis is a direct sedative, and therefore contraindicated in delirium tremens; but, experiment and clinical experience having exposed the fallacy of this dogma, a more docile attention was given to the teachings of facts. In 1860 Dr. G. M. Jones, of Jersey (Eng.), had prescribed a dose of laudanum and chloric ether to a patient affected with delirium tremens; by mistake, however, an ounce of tincture of digitalis was given instead. When he expected to learn that this error had proved a fatal one, he was no less surprised than pleased to find the patient very much better, and that, indeed, he rapidly recovered. Profiting by this hint, he began to give tincture of digitalis in doses of *half an ounce.* If the first dose was not sufficient, which, however, it generally proved to be, a second equally large was administered in about four hours; and if a third was in rare instances required, it did not exceed two drachms. Under their influence, it is stated, the pulse became fuller, stronger, and more regular, the skin grew warm, and the cold clammy perspiration ceased. These effects were followed by a sleep of several hours' duration. No action on the kidneys was observed, nor any alarming symptom. Sixty-six out of sixty-seven cases recovered; the fatal case being one of tumor of the brain.[3] So far as we can discover, the success of the remedy in the hands of other physicians has been almost uniformly equal to that of Dr. Jones.[4] Mr. Gascoigne has reported the success of this mode of treatment in ten cases. The smallest quantity of the tincture required was half an ounce, the largest twenty-eight drachms.[5] Mr. Mankivell cured two severe cases with doses of a drachm repeated every three hours.[6] Mr. Gore, one, in which two doses of the tincture, each of half an ounce, were given at intervals of three hours;[7] and Dr. Wiltshire

[1] N. England Journ. of Med. and Surg., July, 1820, p. 216.
[2] Dublin Quart. Journ., x. 149.
[3] Times and Gaz., Sept. 1860, p. 301.
[4] Compare REID, Edinb. Journ., x 112; Bull. de Thérap., lxviii. 270, 520; Lancet, Jan. 1864, p. 30; Times and Gaz., Dec. 1865, p. 639.
[5] Practitioner, i. 247.
[6] Times and Gaz., March, 1870, p. 336.
[7] Lancet, June, 1870, p. 802.

five cases cured by half ounce doses.[1] We have not met with the record of any case in which the effects of this treatment were either fatal or alarming. The only apparent exceptions to the general safety of this treatment are one or two reported examples of delirium tremens occurring after surgical injuries; but even in these instances the medicine did not appear to produce alarming consequences.

In a case of *typhoid fever* characterized by delirium resembling that of delirium tremens, Dr. R. B. Mowry prescribed tincture of digitalis in doses of thirty minims every hour until sleep occurred. The medicine appeared to produce a marked improvement in the delirium, was followed by a calm sleep, and a rapid convalescence ensued.[2]

In 1863 Dr. Roberts employed this medicine in the treatment of acute insanity, but with indifferent success, for it appeared to depress the pulse unduly and occasion nausea. In the *maniacal excitement* which is apt to occur in the second stage of general paralysis of the insane, he found it, on the contrary, extremely efficacious in moderating the furious turbulence which characterizes that affection.[3] But Dr. Williams considered it equally useful in the acute and chronic forms of mania, when given daily to the extent of from half a fluidrachm to one fluidrachm, suspending its administration if the pulse became weaker or intermitting; but an original feebleness of the pulse he found to be an indication for its use rather than the opposite condition.[4] Dr. S. W. D. Williams also concluded from numerous observations of the use of this medicine, that it possesses a marked power of arresting cerebral excitement of whatever nature it may be, but that it has no further curative powers.[5]

The influence of digitalis upon the delirium of *typhoid fever*, which has been noticed above, does not appear to have attracted the attention of several distinguished observers who studied with great care its power in the treatment of that disease. Wunderlich, Thomas, and Ferber have published the results of their observations[6] upon this point, which were conducted with laborious minuteness, and the first-named author more particularly claims that the medicine modified the course of the disease more favorably than the powers of nature alone, or than these, with the aid of any other treatment, have ever been known to do. Yet there is no evidence furnished that it shortened the average duration of typhoid fever, diminished its mortality, or prevented its graver complications. Its most conspicuous benefits appear to have consisted in a reduction of the temperature of the body and the frequency of the pulse. The more important conclusions, as stated by Wunderlich, may be epitomized as follows: 1. The quantity of digitalis necessary to produce a

[1] Lancet, Aug. 1870, p. 287.
[2] Am. Journ. of Med. Sci., April, 1865, p. 371.
[3] Bull. de Thérap., lxv. 424.
[4] Ibid., lxxi. 43.
[5] Journ. of Mental Sci., Jan. 1866.
[6] Archiv der Heilkunde, iii. 97, vi. 329. Virchow's Archiv, xxx. 293.

marked influence upon the symptoms may be stated at from 30 to 60 grains distributed over from three to five days. 2. The temperature of the body begins to fall before the pulse-rate declines; but both are usually apparent from the first day of the administration. 3. Before the temperature begins to decline it is temporarily increased, and the declension continues for a day after the medicine has been suspended. 4. The pulse falls thirty and from that to sixty beats in the minute, within from twelve to thirty-six hours after the use of the medicine has been systematically undertaken. 5. The reduction of the temperature does not appear to depend upon that of the pulse-rate. 6. The operation of appropriate doses of digitalis in typhoid fever consists, beyond doubt, in an artificial, considerable, and continuous reduction of the fever, especially in a depression of the pulse for weeks together, and in all probability in a permanent moderation of the entire course of the disease. 7. These effects are most manifest during the second week, or at the commencement of the third week of severe cases, "when in the natural course of the disease such a subsidence of fever never, or at least very rarely, occurs." 8. The use of the medicine is unattended with danger, if it is suspended when the pulse-rate rapidly declines. 9. It exerts no injurious influence upon the cerebral or the abdominal symptoms, nor upon the course of the disease. 10. It is chiefly indicated when the fever is unusually high. 11. The medicine should be prescribed in full doses (an infusion of from 15 to 20 grs.) and continued without interruption until its influence is manifested, or the pulse falls to its normal frequency.

Various Diseases.—Van Helmont used digitalis successfully as a local application to *scrofulous* tumors and ulcers, and several other writers report no less favorably of it.[1] But it is alleged to have been still more useful as an internal medicine for the discussion of tumors, by Quarin, Darwin, Kuhn, Parkinson, and others. Hufeland recommends it to be associated with mercury for the resolution of engorged glands. It was also vaunted in diseases attended with pain and nervous derangement, in *spasmodic coughs*, in *convulsive*, and even in *mental disorders*, upon no better ground, it would seem, than a theoretical prejudice in favor of its depressing properties. An examination of the data contained in medical records, of its use in the above-named and kindred diseases, is far from lending support to the reiterated assertion of its efficacy. Cases may have possibly been relieved by its use, in which the spasmodic element rested upon that disorder of the nervous system which grows out of debility. Such a one, for example, may have been the case of *epilepsy* which Parkinson declares that it cured, although of twenty-six years' duration, and also those which are contained in a paper of R. W. Scott;[2] but there is nothing in the general experience of its use to encourage its exhibition in the disease in question.

External Use.—The outward application of digitalis to promote

[1] MURRAY, Apparat. Med., i. 733.
[2] Edinb. Med. and Surg. Journ., xxvii. 19.

the resolution of enlarged glands has just been alluded to. It would seem to have been long employed for this purpose as a domestic remedy, both in England and Italy. A tincture of digitalis has been successfully used in *dropsy*, by bathing the affected part with it and wine of squills.[1] Chrestien was also very successful in treating dropsy following scarlatina, and even intermittent fever, by frictions upon the abdomen with tincture of digitalis.[2] M. Fallot reported three cases of ascites and general dropsy caused by suppression of the perspiration, and which were cured by fomentations of digitalis applied to the abdomen. He used an infusion of a drachm in a pint of water.[3] Dr. Christison states that he has seen diuresis induced by rubbing on the abdomen a mixture of tincture of digitalis and soap liniment, and by placing on it cloths saturated with a strong infusion of the plant, in cases where the ordinary preparations of the medicine, as well as other diuretic remedies, had failed when given by the mouth. But this method is uncertain. In 1830 Dr. Gerhard employed digitalis endermically for the purpose of allaying the action of the heart.[4]

Administration and Dose.—Many of the inequalities and seeming anomalies in the operation of digitalis are owing to the bad quality of the preparation employed. The instances are so numerous in which very large doses have been taken with but slight effects, or none at all, that it must be presumed that the drug was comparatively inert. This may have arisen from the leaves having been gathered while immature, from their having been too hastily dried, or from the fraudulent or careless preparation of the tincture, etc. The rules laid down by Withering continue to be the surest guides for obtaining the due effects of the medicine, and will be mainly followed here. The *powder* is the least certain and most unmanageable of the preparations, but is, perhaps, more generally used than the others. It may be given to adults in doses of from *one* to *three* grains twice a day, either alone or combined with aromatics. The officinal *infusion* is essentially the one recommended by Withering, and may be prescribed in doses of from half an ounce to an ounce two or three times a day. If it tends to purge, opium may be added to it. Dr. Holland, Dr. Munk, and indeed almost all authorities of weight, agree in considering it the most efficient preparation for the cure of dropsy. It is not necessary to the due effect of the medicine that it should be continued until nausea comes on, for the diuretic effect is often first produced; but it should not be suspended until it begins to act *either* on the kidneys, the stomach, the pulse, or the bowels. Then, however, it should at once be discontinued. Its effects, it will be borne in mind, do not subside for several days after the suspension of the medicine.[5]

[1] MÉRAT and DE LENS, Dict.
[2] BAYLE, op. cit., iii. 129.
[3] Bull. de Thérap., xliii. 512.
[4] N. Am. Med. and Surg. Journ., x. 152.
[5] Dr. H. C. Wood, Jr., has reported a case of chronic pleurisy and bronchorrhœa in which the patient's pulse, while she was taking digitalis, suddenly fell from 100 to 49. It was, however, very excitable, and there was a great tendency to syncope. (*Phila. Med. Times*, ii. 24.)

They are most readily induced when a state of rest is maintained. The *tincture* is considered by Dr. Munk to be the most desirable form for administering digitalis when the intention is to affect the heart. The dose of it is from ten to twenty drops repeated two or three times a day. But this we think is an error. The infusion is much more efficient and certain in its operation. Trousseau's wine is an excellent diuretic. It is prepared as follows: white wine, seven hundred and fifty parts; juniper berries, fifty parts; digitalis, ten parts; squill, five parts. Macerate for four days, and add acetate of potassa, fifteen parts. *Dose*, a tablespoonful three times a day.

It is reckoned that one-hundredth of a grain of digitalin is equivalent to one grain of the best powder of digitalis; in other words, that the former is one hundred times stronger than the latter. The great potency of this principle requires it to be used with the utmost circumspection. It ought to be dispensed in such quantities only as will insure exemption from serious accidents. The form of granules prescribed below is a very eligible one for this, as well as for various other medicines which act powerfully in minute doses. Its union with sugar both preserves the medicine unchanged and secures its solution in the gastric fluids.

Formulæ.—℞.—Digitalin, gr. iss; Syrup, Oj. Dissolve the digitalin in alcohol and add the syrup. *Dose.*—Four to six teaspoonfuls a day.

℞.—Digitalin, gr. xvss; Sugar, ℥iss; Water, q. s. Make one thousands granules. *Dose.*—Four to six a day. Each granule contains about one sixty-sixth of a grain of digitalin. Andral thinks it advisable not to exceed the daily dose of three granules on account of danger of a sudden development of the toxical symptoms.

As *antidotes* to the poisonous action of digitalis, wine, opium, and strong coffee have been proposed. Tannin, and substances containing it, have also been recommended, because this principle renders digitalin insoluble. An emetic should of course precede these agents when the symptoms arise from a large quantity of the drug recently taken.

VERATRUM VIRIDE.—American Hellebore.

Description.—American Hellebore is an indigenous species of veratrum, popularly known as swamp hellebore, meadow poke, Indian poke, itch weed, etc. It grows in all parts of the United States, east of the Mississippi, in damp and low situations. It has a stout stem several feet high, furnished with broad, oval, pointed leaves of a yellowish-green color, and its flowers are disposed in dense pyramidal panicles. The rhizome, which is the officinal portion, is thick and fleshy, tunicated above, fleshy below, and sending off numerous whitish radicles. It has a sweetish-bitter taste, and produces a persistent, acrid and burning impression upon the mouth and fauces extending along the œsophagus even to the stomach.

It yields its virtues to water and alcohol. Dr. Thayer, by treating it with alcohol, obtained from it a resin of a dark color, possessing the acrid properties of the root itself. A *fluid extract* was prepared by this gentleman by macerating the root in diluted and strong alcohol. It is of a dark brandy color, and each drop of it is estimated to be equivalent to a grain of the root.[1] The officinal *tincture* is prepared by percolation with sixteen troyounces of the powdered rhizome to the production of two pints of tincture. The botanical affinities of the plant, and its action upon the animal economy, were thought to render it probable that its virtues are owing to *veratria*, the active principle of *veratrum album*. In 1859 Dr. Uhle, of Dorpat, analyzed a specimen of "veratria" sent from New York as the product of *veratrum viride*, and found it identical with that obtained from white hellebore.[2] More recently, Mr. Scattergood isolated the active principles of the plant, and concluded that it contains, besides veratria, a resinoid substance, of soft consistence, and a taste at first oily and nauseous but afterwards acrid. Finally, in 1867, Mr. Charles Bullock, of Philadelphia, announced as the active principles of the drug two, which have since been called *viridia* and *veratroidia*, the former being soluble, the latter insoluble in ether.

History.—Osgood states that this plant was known to the aborigines as a poison rather than as a medicine, and he adds, on the authority of Joselin, that it was made use of by them in the election of their chiefs, the individual whose stomach was least susceptible of its deleterious influence being regarded "as the strongest of the party, and entitled to command the rest." It was also popularly used by the farmers of New England to catch or destroy the birds which ravaged their cornfields.[3] It had long been employed by the late Dr. Tully, of New Haven, and other New England physicians, as a medicine, when attention was for a time particularly attracted towards it in 1835, by the essay of Dr. Osgood just referred to. It appears, however, to have been but seldom prescribed, when the emphatic proclamation of its virtues by Dr. W. C. Norwood, of South Carolina, in 1850,[4] once more caused it to be generally employed, and to be eulogized with that extravagant ardor, and judged with that want of discrimination, which are apt to attend the introduction of all new medicines capable of producing a marked, and above all, an unusual operation, on the animal economy. In 1858 and 1861 Dr. Cutter, of Massachusetts, published an interesting paper on the action and uses of the drug.

Action. *On Animals.*—It has been already mentioned that the farmers of New England have long been in the habit of resorting to green hellebore to protect their crops from birds. They scatter upon the ground corn soaked in a strong infusion of the root, and a short time after the birds devour it their muscular power be-

[1] Bost. Med. and Surg. Journ., Aug. 1858, p. 77.
[2] Arch. für. Phys. Heilk., iii. 404.
[3] Am. Journ. of Med. Sci., xvi. 296.
[4] Southern Med. and Surg. Journ., June, 1850.

comes so much impaired as to prevent their flying or walking, and they are readily taken and killed. Unless caught in this condition, many of them recover and fly away. From experiments upon animals performed by Dr. Percy and Mr. Scattergood, the physiological effects of the alkaloid and the resin appear to have a very great similarity, viz., prolonged emesis, salivation, general prostration, and reduction of the pulse. But the resin produced a much greater reduction of the pulse than the alkaloid. There was no catharsis.[1]

Oulmont performed experiments with the tincture upon dogs, rabbits, and frogs. It was injected hypodermically. Within half an hour the pulse had fallen by 40, 50, and even 100 beats in a minute; the temperature declined as much as from one to five degrees Cent.; the breathing became slower, unequal, and irregular. In animals that vomit, vomiting and purging preceded the other symptoms; but when they were killed, no lesion of the intestinal canal appeared. The most conspicuous symptom was a state of complete prostration, from which neither electrical nor other stimulus availed to arouse the animals. But unless the dose was extremely large they uniformly recovered. On comparing the action of green hellebore with that of veratria, this observer concluded, that while the former produces marked disturbance of the stomach and bowels, and all of its effects with great rapidity, the latter is especially distinguished by successive muscular relaxation and tetanoid phenomena, in addition to those which in common with the other agent it exerts upon the digestive and circulatory apparatus.[2]

Dr. H. C. Wood, Jr., performed a number of experiments upon pigeons, rabbits, cats, dogs, turtles, toads, and frogs with viridia and with veratroidia, used hypodermically. In regard to *viridia*, he found that it is not a local irritant; does not disturb the alimentary canal, nor influence the brain; but lowers the force and frequency of the heart's action, and causes death by arresting the respiratory function. In regard to *veratroidia*, he determined, that locally, it is somewhat irritant; is emetic and cathartic; depresses the heart's action in force and frequency, and causes death by asphyxia.[3] Therefore, the two substances mentioned appear to differ only in the possession of an irritant element by the one and not by the other. Dr. Eugene Peugnet, of New York, also performed a number of experiments,[4] the results of which coincide with those of Dr. Wood, so far as relates to veratroidia; but in regard to viridia they differ so much, not only from these, but from the effects obtained by previous experimenters with the tincture of green hellebore, that the quality of the substance employed may fairly be suspected.

On Man.—In its local action, American hellebore is an active irritant. Its powder snuffed into the nostrils excites long-continued

[1] Am. Journ. of Med. Sci., April, 1863, p. 529.
[2] Bull. de Thérap., lxxiv. 145.
[3] Am. Journ. of the Med. Sci., Jan. 1870, p. 36.
[4] Med. Record, vii. 121.

and violent sneezing, and applied to the skin in a moist state, it produces redness and burning. From some experiments it appears in a slight degree to increase the secretion of urine. All observers agree that it is an emetic. Osgood found that two grains of the powder caused him to vomit, and observed that the act was at first unattended by nausea, and seemed to be performed by the contraction of the stomach and œsophagus alone. But in another person, who also presented this peculiarity, as well as in himself, emesis was subsequently persistent and violent, and attended with bilious ejections. Norwood speaks of it as one of the most certain and efficient emetics belonging to the materia medica, but also states that it often produces extreme nausea, as well as vomiting that is sometimes almost continuous. Yet he elsewhere describes the vomiting as full and free, with frequently little or no retching. A French physician, Robert,[1] seems to imply by the terms of his narrative that the sedative operation of the medicine, to be presently described, is an effect of the nausea which it excites; but Dr. Norwood, and many others, declare that by its careful administration, nausea and vomiting may be avoided altogether. He states, indeed, that the pulse may be reduced as low as thirty-five beats in a minute, without the occurrence of either of these symptoms. In general, the excessive vomiting may be controlled by aromatics and diffusible stimulants.

However close the analogy may be between the effects of the present medicine and of white hellebore in other respects, there is one in which they have been alleged to differ so radically, as to prove, if the statement is true, that they do not owe their virtues to the same active principle exclusively. It is usually said and believed, that the latter agent is a violent irritant of the bowels, uniformly causing purgation when taken in large or poisonous doses. Of American hellebore Osgood said, "It has not the slightest laxative effect," and Norwood declares "it is not cathartic by any means." To these accounts most of the reporters subscribe; but we find that in a case published by Dr. E. M. Pendleton, there were "copious watery evacuations *per anum*,"[2] and in two cases, reported by Dr. E. Platt, that "profuse watery evacuations from the bowels" and "looseness of the bowels," are mentioned among the toxical phenomena;[3] while in three cases, observed by Dr. Rayner, in which an infusion of white hellebore produced violent but not fatal symptoms, there was no purging.[4] It is, therefore, certain that if an absolute difference exists between the two medicines, it is not to be found in their cathartic operation. At the same time it would appear that this effect is most characteristic of white hellebore.

The most remarkable quality of American hellebore is its sedative action on the pulse. Osgood was the first to state that by the

[1] Bull. de Thérap., xliv. 415.
[2] Charleston Med. Journ., vii. 424.
[3] Am. Med. Gaz., April, 1859, p. 249.
[4] PEREIRA, Mat. Med., 3d Am. ed., ii. 184.

exhibition of full doses, the pulse, when ranging from 75 to 80 in a minute, may be reduced to 35 or 40 in the course of a few hours, and become "small and creeping;" but Dr. Branch declares that "when used as it ought to be, it reduces the frequency but never the strength or volume of the pulse."[1] Dr. Worthington, after taking a quarter of a grain of the alcoholic extract, experienced a hot and acrid impression in the mouth and fauces, which also seemed to extend to the stomach. In the course of an hour he had a frequent and distressing hiccup, a sense of weariness and depression, with giddiness, and vomiting renewed every five or ten minutes for an hour, and profuse salivation. Meanwhile the pulse was feeble and thready, and fell from 60 to 22 in a minute. Upon this last point Dr. Norwood is not very explicit, but it may be inferred from his statements that he admits the reduction of force as well as of frequency in the pulse, since he describes among the ordinary effects of the medicine "great coolness of the surface and often icy coldness." Yet he does maintain that the reduction of the frequency of the pulse is not dependent upon the occurrence of nausea or vomiting.[2]

The effects of this agent in excessive doses have been described by Osgood, Pendleton,[3] Platt,[4] Colegrove,[5] Amory, and Webber,[6] and others, in nearly the same terms. They consist of faintness, somnolency, or coma, dimness of sight, dilatation of the pupils, vertigo, headache, rarely delirium, impaired muscular action, general numbness, slow and infrequent respiration, hiccup, a pale cold skin covered with clammy sweat, persistent vomiting, excruciating pain in the præcordia, flatulence, profuse watery diarrhœa in some cases, and a small, infrequent, and generally feeble pulse. Alarming and certainly dangerous as these symptoms are, it does not appear that they have often terminated in death. On the contrary, they have generally been dispelled with facility by suspending the use of the medicine and administering diffusible stimulants. The effect of alcohol in counteracting the sedative action of the poison was shown in the case of a physician who took, by mistake, an ounce of the tincture at one draught. Extreme nausea, vomiting, and some dyspnœa, were the only evil consequences of this large dose.[7] Neither in this case, nor in some others marked by extreme prostration, sedation of the heart, and vomiting, even of blood, were the bowels disordered. A child, eighteen months old, affected with catarrh, took about thirty-five drops of the tincture, and became unconscious, very pale, and cold, breathed stertorously, and was covered with a cold sweat; his pulse rate was 40. He died in about thirteen hours.[8] This, so far as we know, is the only pub-

[1] Charleston Med. Journ., viii. 168. [2] Ibid., vii. 768.
[3] Ibid., June, 1852, p. 433.
[4] American Med. Gaz., April, 1859, p. 247.
[5] Boston Med. and Surg. Journ., August, 1858, p. 96.
[6] Ibid., Oct. 1869.
[7] North American Med.-Chir. Rev., ii. 930.
[8] Boston Med. and Surg. Journ., April, 1865, p. 249.

lished case of fatal poisoning by this drug. Another case, it is true, is reported of a female "suffering from hepatic distress, accompanied by occasional vomiting of bilious matter." An irregular practitioner administered Norwood's tincture of green hellebore, in doses of ten drops every three hours. Severe vomiting occurred after each dose until six doses were taken, when the patient died of exhaustion.[1] It is quite impossible to determine the share which the hellebore had in this event, so long as the nature of the woman's disease is unknown.

This medicine is alleged to have produced abortion in the pregnant female by Dr. W. A. Brown, of Georgia, and others. On the other hand, numerous cases might be quoted in which it was taken with the intent of producing this result, but ineffectually.[2] Undoubtedly, however, an agent which, like this, usually excites prolonged and violent vomiting, ought not to be administered to a pregnant female by a prudent physician, although it may be true that it exerts no specific action upon the impregnated uterus.

The *mode of action* which veratrum viride displays in the cure of diseases has been variously estimated by different observers. Originally, besides its emetic operation and sedative influence upon the heart and nervous system, it was alleged to be deobstruent and alterative, in which last qualities were included resolvent, antipsoric, cholagogue, expectorant, diuretic, discutient, sialagogue, diaphoretic, and emmenagogue powers.[3] In other words, it combined in itself the virtues of nearly all the materia medica besides. Quite recently it is reported by various observers to be expectorant and diaphoretic; and while some, with Dr. Jameson and Dr. Hutchinson, of Indiana, assert that it "indirectly restores the depurating functions of the liver and kidneys," or that "its influence in cleansing the liver is greater than that of any other article," others, like Dr. Boerstler, have "never observed any influence on the glandular system" exerted by it.[4] Dr. Norwood maintains its expectorant, diaphoretic, and deobstruent virtues. He claims for it "powerful effects on the liver," and great efficacy as a nervine, in "allaying morbid irritative mobility in febrile and inflammatory diseases,"[5] whilst Dr. Branch maintains that its greatest value consists in its adaptation to "*asthenic* diseases," that it "is best adapted to adynamic or asthenic conditions of the system," and that it is "a great mistake to regard it as a good substitute for the lancet in phlogistic or sthenic disorders."[6]

It is evident that conclusions so diametrically opposed as these are to one another can furnish no ground either for the employment, or for a rational theory of the mode of action, of the medicine we are examining. It will be observed that the capital discrepancy is upon the question whether it is a stimulant or a sedative, and that,

[1] Med. Record, v. 472.

[2] North American Med.-Chir. Rev., ii. p. 929; Boston Med. and Surg. Journ., Nov. 1857, p. 299, and Dec., p. 436.

[3] Osgood, loc. cit.

[4] N. Am. Med.-Chir. Rev., ii. 914.

[5] Charleston Journ., vii. 766; xii. 197.

[6] Ibid., viii. 168.

while some regard it as having, under all circumstances, a lowering action on the system, involving a reduction in the frequency of the heart's pulsations, others appear to consider this effect, at least so long as toxical symptoms do not arise, as resulting from an augmented tone in the action of the heart. These opposite doctrines are analogous to those which we have seen to prevail in regard to the operation of digitalis, but the grounds upon which a choice should be made between them are not as well determined as in the case of the latter medicine.

Remedial Employment.—The value of veratrum viride in *inflammatory affections* is very difficult to determine upon such evidence as the published records present, for they are too often deficient in a distinct comprehension of the grounds of therapeutical proof, and especially in a clear idea of the nature of diseases. An opinion upon the subject can be of very little weight proceeding from a physician who states that he "found the medicine very useful in croup threatening to run into the membranous form," when it is certain that membranous croup is always such from its inception. Another classes veratrum viride with digitalis, yet declares that "in such diseases as metritis, peritonitis, meningitis, and pneumonia, when fully developed, it has failed in his hands," and he has "been obliged to abandon it and pour in digitalis," in order to gain the victory!

American hellebore has been more extensively employed in *pneumonia* than perhaps in any other disease, but an examination of the records is far from warranting the encomiums which have been lavished upon its virtues. The first to eulogize them was Dr. Osgood, in 1835, who says that the medicine has been advantageously employed, "except in low typhoid cases," while Dr. Branch assures us that it is best adapted to this very form of the disease—viz., adynamic pneumonia. An examination of the cases published by Drs. Robert,[1] Livezey,[2] Handy,[3] Spalsbury,[4] Chapin,[5] Cutter,[6] Toland,[7] Watson, Murphy, and McGugin,[8] shows that the opinions expressed by the reporters are not always sustained by the facts on which they profess to be founded. It must be confessed that when we meet with such general expressions as that the medicine "is invaluable in pneumonia;" that it may be considered "as much a specific in pneumonia as quinine is for intermittent fever" (*Norwood*); and when we find it said of pneumonia with rusty sputa that "its further progress was subdued" by the medicine; and when curative virtues are claimed for it in cases for which bleeding, calomel, tartar emetic, blisters, and senega were also prescribed, the only rational conclusion to be drawn from such statements is that they are of no value in solving the question of the utility of veratrum viride in this affection. In 1867, Biermer, of Berne, treated sixty cases of

[1] Bull. de Thérap., xliv. 416. [2] Boston Journ., March, 1857, p. 138.
[3] Ibid., April, 1857, p. 256. [4] Ibid., March, 1858, p. 113.
[5] Am. Journ. of Med. Sci., Oct. 1858, p. 311.
[6] Ibid., p. 315. [7] Ibid., p. 576.
[8] N. Am. Med.-Chir. Rev., ii. 921, etc.

pneumonia exclusively by the resin of green hellebore. The results were announced as "astonishing." The pulse and temperature fell in a remarkable manner, the disease ran a very short career, and the mortality was 8.3 per cent. Oulmont met with an equally flattering success in several cases, and Kiemann[1] found it much superior to digitalis (which it might well be without possessing any merit). Yet he honestly expressed surprise "that the mortality seemed higher than it ought to be," a surprise which will not seem warranted to those who are familiar with the influence of good nursing and restoratives in the treatment of pneumonia. Hirtz, of Strasbourg,[2] while recognizing the force of this consideration, insists that certain symptoms which denote a fatal tendency may be moderated by veratrum viride, and that the pulse and temperature may be kept down, etc. But it should not be forgotten that it is not these symptoms *per se*, but the cause of them which indangers life, and of the nature and intensity of that cause we can obtain no direct evidence, and therefore none of the action upon it of this or any other medicine. An ancient and familiar maxim, and as true as familiar, is *sublatâ causâ, tollitur effectus;* but the converse has never been recognized as a truth. On the contrary, it is illogical and opposed to all experience to presume that a cause is destroyed because its effects are neutralized.

The records of the treatment of pneumonia by veratrum viride are generally of a description which proves their reporters apt to attribute every favorable change in a disease to the last remedy administered. If it were true, as one asserts, that sometimes "its use is followed by such an immediate change in the character of all the symptoms, that the disease seems to be annihilated as if by magic, and convalescence established at once," it would stand alone in the catalogue of medicines, the sole exponent of a medical thaumaturgy. Unfortunately, the negative or the opposite results of its use outweigh by far the flattering testimonials of its success. It should never be forgotten that pneumonia is a self-limited disease; that a comparison of various active and perturbative modes of treating it proves them to be all very nearly upon an equality as regards their curative power; and that the plan which has been attended with least mortality is, on the whole, one of purely medicinal expectation.

It is also said to be advantageous in *pleurisy*, but there is no sufficient evidence that it is so. In a case reported to demonstrate its value in this affection, depletion, calomel, and a blister dressed with mercurial ointment were first employed, and the veratrum having then been administered, the pulse indeed fell from 120 to 60, but the patient complained bitterly of distress, and hysterical symptoms supervened.[3] This and similar examples which have been published are very inconclusive, but it is quite possible that the medicine may, by its sedative influence, assist in moderating the pleuritie pain and

[1] Prager Vierteljahrs., 1868. [2] Bull. de Thérap., lxxvi. 468.
[3] New York Journ. of Med., Sept. 1855, p. 254.

the plastic or serous effusion, and may consequently promote the absorption of the latter.

In *acute rheumatism*, according to Osgood, it is more efficacious than any other remedy, if administered so as to sustain its impression, and at first without producing nausea. But this physician prescribed it in conjunction with opium, one of the best remedies for the disease in question. Dr. Silver,[1] has reported six cases of acute articular rheumatism in which the subsidence of the temperature, and the advent of convalescence seem to have been remarkably rapid under the use of this medicine, which was given in doses of two minims every hour during the day, and of four minims every four hours during the night. In some cases of acute erratic rheumatism of the joints it would appear to have been occasionally useful.[2]

It is unnecessary to refer in detail to the alleged efficacy of American hellebore in *chronic rheumatism*, in *gout* and *dyspepsia*, or in *scarlatina*, *measles*, *yellow fever*, and *typhoid fever*, but it may be stated that Dr. Norwood says of it in the last-named disease, "We rely on it as *the* remedy, and administer it with every assurance of success." His plan is to reduce the pulse to between 55 and 75 beats a minute, and keep it at the point desired night and day. "By this kind of reduction the febrile and inflammatory symptoms vanish, and the patient is kept quiet and tranquil and comfortable;" and "it is out of the question for febrile and inflammatory action to exist and continue their ravages for any great length of time when the pulse is kept at 60 or 65 beats, or even less."[3] Dr. Branch is quite as well convinced of the utility of the medicine in all stages of typhoid fever; but he adds, "The disease never requires reducing agents," a class to which he denies that this medicine belongs; and while he lessens the rate of the pulse by its means, he administers paregoric, and sometimes brandy, to sustain the strength and allay agitation.[4] We can with difficulty persuade ourselves that typhoid fever, a disease eminently specific in character, and most dangerous when its type is most asthenic, could be profitably treated by a medicine which tends so directly as this to produce infrequency and then depression of the pulse, and ultimately, collapse of the whole system. Even admitting, what appears not to be improbable, that its primary action on the heart is not debilitating in its nature, it is separated from its toxical action by so narrow a space, and the latter must be so hazardous in this disease, that we should feel very reluctant to run the risk of inducing it without more substantial reasons than any which have yet been assigned by the eulogists of the medicine.

Dr. J. Waring Curran[5] claims that this medicine exhibits peculiar virtues in *acute pericarditis*, when it is prescribed in doses of two grains of the extract with one grain of calomel every two hours

[1] Trans. Lond. Clin. Soc., iv. 77.
[2] Am. Journ. of Med. Sci., Oct. 1858, p. 317.
[3] Essay, 1856, p. 9.
[4] Loc. cit., p. 169.
[5] Rankings' Abs., lviii. 79.

until its specific effects are discernible. According to him, "the distressing symptoms are kept at bay until the calomel does its duty, and the disease is mastered." The utility of calomel in pericarditis is nothing less than proven, and its association with veratrum is, therefore, unnecessary. As regards the latter medicine, it seems not incredible that by slowing the heart's movements it may tend to limit the formation of exudation matter, but clinical proof of its virtues in this respect has not been produced. It is probable that it can only act beneficially during the early stage of the attack; at a later period its action would seem fitted to favor the hardening of the exudation, and the adhesion of the pericardium to the heart.

But there is another class of cases in which veratrum viride is represented to be beneficial, cases of an undue action of certain organs, independently of fever. Osgood recommended it in *nervous asthma*, and the analogy of the effects of nauseants and nervous sedatives in this affection would lead us to suppose that it might be beneficial, and not only in cases which are free from organic complication, but in some also in which emphysema and *organic disease of the heart* coexist, as well as in those of *nervous palpitation* of this organ. The benefit experienced in several instances of both forms of cardiac disorder has been very decided, and tends to prove that the medicine did not produce such marked relief by any debilitating influence. The cases reported include examples of nervous excitability with muscular atony of the heart, and others of great embarrassment of the circulation from valvular disease;[1] but in all the relief was marked when the rate of the pulse diminished, although none of the toxical effects of the drug were developed. Dr. Percy has pointed out a very important application of the medicine in heart disease.[2] Every one accustomed to the investigation of organic affections of the heart has been embarrassed in making a precise diagnosis by the tumultuous or the rapid action of the organ. In veratrum viride we possess an agent by which the movements of the heart can readily be rendered so much slower and more regular as to enable us to analyze with comparative ease its abnormal phenomena, and refer them to their proper physical cause. At the same time, it must not be forgotten that, if the medicine is given in such doses as will excite protracted nausea and vomiting, it may do more harm than good. Drasche, of Vienna, complains that in his hands it induced such a state of anxiety and collapse that he was obliged to abandon its use.[3] A case of *puerperal mania* is reported by Dr. A. B. Clarke, in which the remissions and exacerbations of the disease clearly coincided with the administration and suspension of the hellebore.[4] The pulse being rapid, although there was no fever, proves the attack to have been one of nervous excitement associated with true debility. In such cases it is that opium acts so beneficially, and we may presume that the hellebore in this

[1] Am. Journ. of Med. Sci., Oct. 1858, p. 312.
[2] Am. Med. Times, vii. 9.
[3] Practitioner, ii. 117.
[4] Boston Med. and Surg. Journ., Oct. 1858, p. 237.

instance did so by a sustaining rather than by a debilitant action upon the nervous system.

The medicine is also reported to have been used with advantage for *influenza*, *gout*, *femoral aneurism*,[1] *dysentery*, *jaundice*, and *puerperal peritonitis;* but, except in the case of aneurism, we should feel disposed to question its efficacy. In this disease, other sedatives of the circulation, and especially the preparations of lead, have occasionally effected cures.

Externally the tincture of green hellebore is useful as a discutient and anodyne application.

Administration.—The *powder* of American hellebore may be given in the dose of two grains, repeated every three hours, as a sedative; but more than that quantity will be apt to excite vomiting. An *extract*, prepared as described at the commencement of this article, may be prescribed in doses of a quarter or half a grain. Of the *fluid extract* the dose is one to three drops.

The officinal *tincture* is the most usual form for administering this medicine. Six or eight drops may be given to an adult every three hours, and the dose increased by one or two drops at each administration, until nausea is felt or the pulse begins to fall. Females, and lads from fifteen to twenty years of age, should not exceed five drops for the dose; and for children from one to five years old a sufficient quantity is one drop. The toxical effects of the medicine are best relieved by means of alcoholic stimulants and opiates.

ANTIMONII ET POTASSÆ TARTRAS. Vid. *Emetics*.

[1] BLACKMAN, Am. Journ. of Med. Sci., July, 1857, p. 190.

Class X.

NERVOUS SEDATIVES.

As it has been intimated elsewhere, the direct causes of sedation or depression necessarily originate in the nervous system, since all the phenomena of life in man depend directly upon its influence. In dividing sedatives, therefore, into arterial and nervous, we have only the intention of indicating the fact that certain of these agents display their influence more conspicuously upon the one or the other system. In the case of digitalis and veratrum viride, the phenomena exclusively dependent upon the nervous system are inconsiderable, while the arterial circulation is prominently affected. Aconitum, conium, cocculus, dulcamara, tabacum, lobelia, and veratrum album, act, indeed, as sedatives of the circulation, but exert more prominently and immediately a depressing or disturbing influence on the involuntary portions of the nervous system. Aconitum, conium, and veratrum album affect the nerves of general sensibility as well; but none of the group disturb the proper functions of the brain, perception and intellection. Arterial and nervous sedatives agree in producing a disturbance of the digestive function, and, when taken in large doses, vomiting, often purging, and a state of general prostration, with coldness of the surface, which is generally designated by the term collapse.

Regarding them from a therapeutical point of view, the classification of the articles included in the present division would be widely different from that which we actually adopt. Aconite and white hellebore are peculiarly adapted to the palliation or removal of local pains and their causes; hemlock and bittersweet exert a peculiar influence upon the functions of organic life, and are applied chiefly to the treatment of chronic diseases involving defects or errors of nutrition; tobacco and lobelia are employed principally as nauseants to produce relaxation of the muscles, and sometimes an increased secretion from the mucous membranes; and cocculus is seldom prescribed internally.

The special uses of these medicines, as of all others, have grown out of a long observation of their curative properties, and the facts just noticed may be added to many others, which have also been pointed out in this work, and which prove that, however valuable as an explanation or as a commentary a knowledge of the *modus*

operandi may be, it must nevertheless be always held as subordinate in value to the conclusions of direct experience.

ACONITI FOLIA.—Aconite Leaves.

ACONITI RADIX.—Aconite Root.

Description.—Aconite is a plant of the Nat. Ord. *Ranunculaceæ*. The principal species are four, *A. anthora*, *A. lycoctonum*, *A. ferox*, and *A. napellus*. They do not differ materially from one another in essential qualities, but the last only is officinal. It is a native of, or has at least long been cultivated in Europe, as an ornamental as well as a medicinal plant, on account of the great beauty of its dark-blue or violet-colored flowers, which are helmet-shaped, and arranged in a terminal spike or panicle. The stem is erect and simple. The leaves, which are palmate, deeply cleft, pinnate, and serrated on the edges, are of a fine shining-green color, and when fresh have a faint narcotic odor. In their recent state, and also when dried, they have a bitterish, acrid taste, which is followed by a tingling sensation, and even soreness in the mouth and fauces, which subsequently, however, grow benumbed. The root is fleshy and fusiform, resembling that of the wild turnip (whence the name *napellus*, a diminutive of *navus*, *navet*, Fr.), and is furnished with fleshy fibres; it is three or four or more inches long, and of a coffee-brown color without and white within. In its taste and effects on the mouth it resembles the leaves. Sometimes several roots are joined together laterally. On being dried it shrivels, and grows darker. Its active properties are most developed in the spring.

The properties of aconite depend upon an *aconitia*, an alkaloid, which is furnished by the whole plant, but most abundantly by the root. It is partially crystallizable, of a vitreous lustre, of a white color when pure, heavier than water, unchanged in the atmosphere, and soluble in alcohol and ether.

A specimen of a root sent from China, as that from which the arrow-poison of the Chinese is procured, was pronounced by Prof. Christison to belong to a species of aconite.[1]

It is stated above that the effects of the non-officinal species of aconite do not differ materially from those of *A. napellus*. This has been fully shown, by the experiments of Schroff,[2] to be true of *A. ferox*, which, however, exhibits these effects in greater intensity. The following preparations of aconite are officinal:—

Aconitia.—*Aconitia.*

Powdered aconite root is exhausted by alcohol, to which, after reduction, sulphuric acid is added. The solution having been freed of its oily and resinous portions by means of ether, the aconitia is precipitated by means of ammonia, redissolved by ether, and after

[1] Edinb. Med. Journ., April, 1859, p. 869. [2] Journ. f. Pharmakodyn., i. 335.

decantation procured by evaporating the menstruum. As thus obtained, aconitia is a yellowish-white powder, without smell, and of a bitter, acrid taste, accompanied with a sense of numbness. It readily dissolves in alcohol, ether, and chloroform, but with difficulty in either cold or boiling water.

EXTRACTUM ACONITI.—*Extract of Aconite.*

It is obtained by exhausting with alcohol and by percolation recently dried and finely powdered aconite leaf, and reducing the extract to a proper consistence by evaporation.

TINCTURA ACONITI RADICIS.—*Tincture of Aconite Root.*

It is prepared with twelve troyounces of powdered aconite root and a sufficient quantity of alcohol to produce two pints of tincture by percolation.

EMPLASTRUM ACONITI.—*Aconite Plaster.*

An alcoholic extract of sixteen troyounces of aconite root is added to sufficient resin plaster to make the mixture weigh sixteen troyounces.

History.—The word aconite is derived, according to Pliny, from ακονη, a rock, because the plant grows in dry and rocky places; although others fancifully imagine the name to be used figuratively, and to denote the power which the plant has of destroying life, as the grindstone wears away the edge of a knife.[1] Lémery and others state, after Theophrastus, that some derive the name from Acone, a port of Heraclea, where the plant grows abundantly.[2] Almost the only mention made by the ancients of aconite as a medicine is contained in the treatise of Dioscorides, who states that it is employed in collyria to relieve pain in the eyes,[3] and it is precisely for this and similar affections that its use has been of late revived. But its most ordinary employment by the ancients was as a poison for wild beasts that were to be destroyed, lest they should overrun the country. For this purpose it was rubbed upon pieces of meat which were then scattered in the way of the animals. Medea is represented by Ovid as preparing her poisons from it; it was also used, like conium, as a State poison. The Gauls dipped their arrows in its juice, and at the present day some Eastern tribes are said to use it for the same purpose, as well as for poisoning the wells and water-tanks of their enemies in time of war.[4]

Action. *On Animals.*—Aconite appears to be poisonous to all animals and insects. The experiments of Wilcourten, Larrey, Wepfer, and Spræger, developed essentially the same phenomena as are described below, and after the death of the animals the vessels of the head, and the left side of the heart, were found distended with blood.[5] In like manner the more recent experimenters, Fleming, Shultz, Van Praag, etc., found that earth-worms, fish,

[1] MATTHIOLUS, op. cit., p. 399. [2] Traité Universel de Drogues Simples, p. 12.
[3] Chap. lxxii. [4] DIERBACH, iii. 1162.
[5] GIACOMINI, op. cit.

serpents, frogs, and birds, were all affected with general loss of sensibility, and paralysis terminating in death.

In 1812, Sir Benjamin Brodie performed a series of experiments on the action of poisons, from which he inferred that aconite, alcohol, the essential oil of bitter almonds, the empyreumatic oil of tobacco, and woorara, act as poisons simply by destroying the functions of the brain.[1] Such a grouping of agents, and such an explanation of their operation, are not admissible in the present state of our knowledge. His own experiment with aconite amounted simply to this, that the animal experimented upon, a cat, lost the power of locomotion, was slightly convulsed, breathed slowly and laboriously, and so died. A minute and a half afterwards the heart was contracting regularly one hundred times in a minute. According to Pereira,[2] if a small quantity of the soft alcoholic extract of the root of aconite be introduced into a wound (or into the cavity of the peritoneum) in a dog, it usually causes vomiting (sometimes of a stercoraceous character), diminishes the force of the circulation, weakens the muscular system so as sometimes to make the animal stagger in walking, and destroys the common sensibility, without causing stupor. A dog, under the influence of not a too strong dose, will sometimes follow its owner around the room, recognize him by wagging his tail when called, and yet be totally insensible to pinching, pricking with needles, etc. Slight convulsions sometimes occur just before death. The heart examined immediately afterwards does not pulsate (?). If too large a dose, in proportion to the size of the animal, be given, the phenomena detailed above are not witnessed, because death takes place so rapidly as to obscure the insensibility which depends directly upon the poison. Dr. Fleming noted essentially the same phenomena in his experiments.[3] When first introduced into the system, aconite produced weakness of the limbs and staggering, disordered breathing, paralysis and relaxation of the extremities, impaired general sensibility, blindness, slow and imperfect breathing, spasmodic twitching, and death. The heart was found to beat for some time after the death of the animal; the venous system was congested in all its parts. The result of twenty-five experiments performed by Dr. Robert Jackson on rabbits, cats, and dogs, differed in no respect from the foregoing; it is to be remarked, however, that the most rapid effects were observed after the use of the fresh juice of the root.[4] From these experiments the force of the poison would appear to be expended upon the nervous system, attacking the organs of motility first, and then those of sensibility. The muscles of purely voluntary motion seem to be the first and principal, if not the only parts of the muscular system affected, if we may depend upon the uniformity of the phenomenon observed by Fleming and Brodie, and which are opposed to Pereira's observation, viz., the pulsation of the heart after the extinction of animal life.

[1] Ed. Med. and Surg. Journ., viii. 458.
[2] Mat. Medica, etc., 3d Am. ed., ii. 1087.
[3] Month. Journ. of Med. Sci., 1845, p. 506.
[4] Lancet, May, 1856, p. 478.

On Man.—Among the earliest narratives which illustrate this subject, may be cited that of Matthiolus, who informs us,[1] that for the purpose of testing certain alleged antidotes he attempted (A. D. 1561) to poison four criminals who were under sentence of death, two of them at Rome and two at Prague. One only of the number survived, the rest suffered a more terrible death than that by hanging. The symptoms of one of the culprits who perished occurred in the following order: Lassitude, prostration, a sense of sinking at the heart, which did not prevent the patient from speaking and seeing clearly; a cold sweat succeeded, and the pulse grew feeble; convulsive twitches of the lips and the eyes, and drawing of the head backwards, were followed by complaints of chilliness, looseness of the bowels, and vomiting, which seemed to afford relief; the man turned upon his side as if to sleep, but his face grew livid, and he was presently dead.

The most detailed account of the toxical properties of aconite is contained in the Inaugural Essay of Dr. Fleming, which received a gold medal from the University of Edinburgh at the graduation of 1844. His experiments and observations upon man were made in the Infirmary of the town just named. The following is an extract from his Treatise:—

"*First Degree of Operation.*—In the course of twenty minutes or half an hour after the exhibition of five minims of the tincture of aconite, a feeling of warmth in the stomach is usually experienced, which is occasionally accompanied by slight nausea, and oppression of the breathing. After the lapse of thirty or forty minutes this sense of warmth is diffused throughout the body, and in a few minutes more is attended by numbness, tingling, and a sense of distension of the lips and tongue. There is also a tingling at the tips of the fingers, and a peculiar sensation is felt at the roots of the teeth. The feeling of warmth soon subsides, but the numbness and tingling of the lips and fingers continue for a period varying from one to three hours. Slight muscular weakness is generally experienced, with indisposition for exertion either mental or corporeal. In about half an hour more the pulse is found to be diminished in strength; and in another hour both the pulse and respiration have become less frequent. Thus, a pulse which in the normal state beats seventy-two in a minute, will by that time have fallen to about sixty-four, and the respirations, supposing them to have been eighteen, to fifteen or sixteen.

"*Second Degree of Operation.*—Should a dose of ten minims be given at first, or the dose of five minims be succeeded in two hours by another of equal amount, these symptoms supervene more rapidly and with greater severity. The tingling extends along the arms, and the sensibility of the surface is more or less impaired. In an hour and a half the pulse will probably have fallen to about fifty-six beats in the minute, and become smaller and weaker than before, still maintaining, however, perfect regularity. The respi-

[1] Commentaire, p. 400.

rations will have diminished to about thirteen, presenting, at the same time, a slow, laboring character. Great muscular debility is now experienced; and giddiness, with confusion of sight, comes on when the erect posture is assumed. The individual sinks into a lethargic condition, evinces great disinclination to be disturbed, although he rarely falls asleep, and complains much of chilliness, particularly in the extremities, which are cold to the touch. These phenomena continue in their full intensity from three to five hours, when they gradually disappear; a sensation of languor, which lasts for several hours more, alone remaining. This is the utmost extent to which I would recommend the physiological effects of aconite to be carried, in order to obtain, with safety and success, its therapeutic action.

"*Third Degree of Operation.*—On the administration of five minims more, two hours subsequent to the last dose, the sense of warmth and the numbness and tingling again spread rapidly over the body. The sensibility of the surface is still further diminished; lancinating pains in the joints are occasionally complained of; the headache, vertigo, and dimness of vision are aggravated; the countenance grows pale and anxious; the muscular feebleness increases; the voice becomes weak, and the individual is frequently impressed with the dread of approaching dissolution. Occasionally the pulse is reduced still further in strength and frequency, perhaps falling to 40 or even 36 beats per minute, but still maintaining its regularity. More frequently, however, it rises to 70 or 80, and becomes small, weak, and probably more or less irregular. The respiratory movements are also irregular, being either short and hurried, or deep and sighing. The surface is moist and still further reduced in temperature. Sickness may now come on; and if formerly present, is much aggravated, and probably attended by vomiting. These symptoms do not entirely subside for one or two days.

"*Fourth Degree of Operation.*—On the administration of a fourth dose of five minims, two hours after the third, the symptoms assume a more alarming character. The countenance becomes pale and sunken, froth issues from the mouth, and prostration increases. Some thus affected have stated that they felt as if dying from excessive loss of blood. Consciousness usually remains; or there may be slight wandering delirium, as occurs also after profuse hemorrhage. The voice is whispering, or is altogether lost. The pulse becomes still smaller, weaker, and more irregular, and the breathing more imperfect; the surface is colder than before, and is covered with a clammy sweat. I have seen patients recover from this state under the administration of proper remedies.

"When the action of the drug is carried to a fatal extent, the individual becomes entirely blind, deaf, and speechless. He either retains his consciousness to the last, or is affected with slight wandering delirium; the pupils are dilated; general muscular tremors, or even slight convulsions, supervene; the pulse is imperceptible both at the wrist and heart; the temperature of the surface sinks

still lower than before; and at length, with a few hurried gasps, death by syncope takes place."

From these experiments and observations the author infers that aconite is a sedative of the cerebro-spinal system, by its direct action upon the nervous matter and on the heart, and by its indirect action on both, through the congestion to which it gives rise. In the action of aconite on the pulse, a distinction is to be made. The direct and immediate influence of the drug administered in small quantities is to reduce the frequency of the pulse, according to the author just quoted, to 60, 48, 40, and even 36; but if the sedative action on the system is allowed to proceed much further, the pulse rises in frequency, becomes irregular and intermittent, and smaller and weaker. The latter characters are ascribed to the pulse in nearly every case of fatal poisoning by aconite.

Several, and indeed most, authors mention a symptom which is scarcely alluded to in the narrative of Dr. Fleming's experiments, an increase, namely, of the cutaneous exhalation, with excessive itching, and formication, and an eruption of vesicles. Large doses of aconite are said also to leave behind them feebleness of digestion, with bilious or bitter eructations, a yellowish tinge of the complexion, and, if the medicine has repeatedly given rise to its specific symptoms, sometimes to distinct jaundice.[1] Dr. Fleming enumerates as effects of a long-continued use of the medicine, general tremors, severe pain in the head and eyeballs, constant lachrymation, intense photophobia, heat of skin, quick pulse, and great restlessness.[2] Vogt places aconite in the same category with digitalis and tobacco, and between these agents and conium, as regards its influence on the economy.

The practical inferences which Dr. Fleming deduces from a consideration of the action of aconite on the circulation are as follows:—

"1. That it is a powerful antiphlogistic.

"2. That it is calculated to be of great value in all cases where there is inordinate activity of the circulation.

"3. That it is contraindicated when there is an obvious mechanical impediment to the passage of the blood, particularly through the heart or lungs.

"4. That it is contraindicated whenever there is irritability of the circulation, with great diminution of power, such as occurs after severe venous hemorrhage."

An analysis which we have made of twelve of the more recently published cases of poisoning by aconite, four of which terminated fatally, has furnished the following results, which coincide very nearly with those obtained by Dr. Fleming, and by others who have described individual cases of this occurrence, or have given summaries of their observations. It is also to be noticed that there is nothing except the *degree* of debility and coldness to distinguish the fatal cases from those which recovered. Retching and vomit-

[1] Vogt, Pharmakodynamik, ii. 248. [2] Edinb. Med. Journ., viii. 503.

ing are mentioned in a majority of the cases, and in nearly all it was accompanied by intense thirst, and a burning sensation in the fauces, throat, and stomach. The face was generally pale, and in two cases which recovered was slightly affected with spasms; the skin was pretty uniformly cold and clammy, or bathed with a copious perspiration, and was sometimes the seat of formication; in no instance is insensibility of the integument mentioned as having occurred until death became imminent. A general feeling of heaviness of the limbs affected nearly all the patients, and in one fatal case paralysis of a lower extremity is mentioned. In four, there were more or less general convulsions, and in two, spasms and rigidity of the muscles upon the posterior part of the neck and trunk. In two cases the pupils were insensible to light, and in both of these cases, which, however, recovered, there was blindness. In three other cases, two of which were fatal, the pupils were dilated. In one case, only, the breathing is stated to have been stertorous, and in two others it is described as slow. In these three cases there was either coma or deep sleep, and all of them terminated favorably; in the remainder, consciousness was not impaired until death, or immediately before it. In one of the four fatal cases no examination of the body was made; in the three others there were no uniform lesions; the stomach was pale or dark-colored, and the brain natural or deeply congested. The blood in the heart was liquid in two cases, and in the third its condition was not noted. In a fatal case, reported by Dr. A. S. Taylor,[1] great capillary bright-red congestion of the larger end of the stomach, with softening and separation of the mucous membrane, was observed. These lesions may have been partly due to ammonia, which, with brandy, had been administered to the patient.[2]

The operation of *aconitia*, when taken internally, differs from that of aconite only in degree and in the rapidity with which its effects arise. Reil dissolved $1\frac{3}{5}$ grain of aconitia in 200 drops of alcohol, and took from 5 to 30 drops ($\frac{1}{25}$ to $\frac{1}{4}$ grain), diluted with water, in gradually increasing doses. He experienced a feeling of fulness in the cheeks and temples, which by degress was exchanged for a painful sense of tension, formication, and prickling; the temples throbbed, the head ached, the eyes felt strained, the pupils were dilated, the sight was obscured, there was oppressed and suspirious breathing, ringing in the ears, and increased urination. There was also a sense of heat in the stomach, with eructation, and, for three days following, nocturnal pollutions, to which the experimenter was not accustomed.[3]

The more detailed experiments of M. Hottot gave the following

[1] Guy's Hosp. Rep., 3d ser., x. 187.

[2] The following later cases of poisoning by aconite may be referred to: Edinb. Med. Journ., xi 163; Lancet. July, 1866, p. 34; Ibid., Feb. 1867, p. 238; Glasgow Med. Journ., iii. 492; Boston Med. and Surg. Journ., July, 1870, p. 41; by external application, Dublin Quart. Journ., Nov. 1862, p. 477; Boston Med. and Surg. Journ., Feb. 1872, p. 74.

[3] Mat. Med. d. rein. chem. Pflanzenstoffe, p. 26.

results. They were performed upon himself and two associates, and the dose of the medicine was gradually raised to one-twentieth of a grain. The effects of that quantity were summarily as follows: a sense of acrid heat in the mouth and throat which extended to the stomach and rapidly became more intense, and was attended by profuse salivation. Almost simultaneously were experienced general malaise, debility, and heaviness of the head; then nausea, gaping, oppression, formication in various parts, but chiefly in the face and extremities. By degrees the depression increased, and lancinating pains were experienced especially in the course of the nerves of the face, and the nausea was accompanied with vomiting. As muscular debility augmented, the formication was more decided, especially during rest; the limbs felt benumbed, the features were tense and swollen; the pulse fell, the breathing grew slow and labored, and copious perspiration broke out. Still later the sense of exhaustion became extreme, and the least effort was painful; it became difficult to grasp anything; the mind remained clear, and there was no drowsiness. The pupils were dilated, but contracted readily in a strong light. These phenomena were of five or six hours' duration, and gradually gave place to natural feelings; but the last to be dissipated were the acrid taste, the heaviness of the head, and the general muscular soreness and debility.[1]

When this substance in ointment or solution is applied to the skin, it produces itching and prickling, followed by insensibility of the part, and without reddening it in the least.

Remedial Employment. *Rheumatism and Gout.*—In these diseases aconite was from the first employed by Stoerck, and his numerous imitators soon popularized its use throughout Europe. This author remarks that what chiefly gives merit to the medicine is the rapidity of its effects, for it will, in the space of a few days, not only alleviate, but cure, and that with certainty, those who had for months and even years, been afflicted with pains and deprived of the use of their limbs.[2] Nor was confirmation wanting for so extraordinary a statement, and many of Stoerck's contemporaries published accounts of not inferior success. But subsequent experience has proved them to have been exaggerated, while it has accorded a real and more definite value to the medicine. One of the first among more recent authors who have contributed to our knowledge upon the subject is Tessier, of Lyons, who, in 1834,[3] recalled attention to aconite as a remedy for acute rheumatism. He alleges that it calms rheumatic pains, especially of the large joints, so rapidly that in an hour after its administration, a striking amendment can sometimes be observed, although more commonly twenty-four or thirty-six hours are required to produce the effect. He found, moreover, that it hastened in a remarkable manner the absorption of synovial effusions, and that without giving rise to any excretion by the skin or bowels. Dr. T. pre-

[1] Annuaire de Thérap., xxiv. 51.
[2] Apparatus Med., iv. 19.
[3] Bull. de Thérap., vii. 53.

scribed the alcoholic extract of aconite in doses of a quarter or a half of a grain twice a day, which he increased until the daily dose reached six, or from that to nine grains. Pereira assures us that in rheumatic pains unaccompanied with local swelling or redness, aconite is frequently of great service as a local application. In painful affections of the intercostal and other respiratory muscles, occurring in rheumatic individuals, he also found this remedy most valuable both internally and topically. Sigmond indicates the very opposite condition as one in which aconite is useful, viz., when the joints are tumefied, painful, hot, and elastic to the touch; and he remarks, that it is sometimes wonderful to witness the speedy relief of the pain, and the restoration of the health, even when the whole joint appears to be involved in the disease. "In all the various seats of rheumatic inflammation, whether the disease have been of long or short duration, however great the agony which has been expressed, however incapable the limbs have been of bearing the slightest motion, aconite has been acknowledged to have proved of the most decided service."[1] But the most complete and accurate account of the effects of aconite in rheumatism is contained in the essay of Dr. Fleming, already referred to. In the acute form of the affection relief was more speedily obtained than by any other means whatever; indeed, the author represents the duration of the treatment as less than half of that required under other methods. The improvement, too, appears to manifest itself very speedily, often within an hour after the first dose has been taken; no unpleasant symptoms follow; the heart seems less liable than usual to inflammatory complications; and the convalescence is extremely short. Dr. Fleming found also, like Lombard, that this mode of treatment contributes powerfully to the absorption of the fluid in articular rheumatism. In the chronic form of the disease he met with corresponding success, in the use of aconite, both internally and externally. It possesses, he remarks, the great negative advantage of not impairing the constitution of the patient; a most important quality, as every practitioner must acknowledge. Dr. Busse, of Berlin, has also witnessed its efficacy,[2] and more recently we find singularly rapid cures of both acute and chronic rheumatism ascribed to it by Balfour.[3] Dr. Samuel Wilks claims for aconite an extraordinary power in absolutely arresting acute articular rheumatism, and one or two cases which he narrates would seem to justify his opinion.[4] Mr. Henry Power finds that rheumatic affections of the eyes yield rapidly to aconite with colchicum and camphor;[5] yet a later writer, setting forth the virtues of the drug, does not allude to rheumatism as an affection which illustrates them.[6] It must be confessed that as experience enlarges the less disposition is there among judicious physicians to regard aconite as an appropriate remedy for rheumatism, or to confound the palliation of its symptoms with the cure of the disease.

[1] Lond. Lancet, Aug. 1837.
[2] Month. Journ. of Med. Sci., May, 1853.
[3] Ibid., May, 1853, p. 432.
[4] Practitioner, i. 335.
[5] Ibid., iii. 221.
[6] Ibid., vi. 207.

Aconite has been recommended in *gout* by most of the writers who have found it useful in rheumatism. It has been prescribed both locally and internally. There can be no doubt that in the former mode of using it aconite more than any other application is capable of mitigating the excruciating pains of gout. Internally, according to Ditterich,[1] it produces a very decided amelioration of the symptoms; from the first day of its use the pulse is calmer and softer, the local heat is assuaged, and often a general sweat occurs by night, after which the color of the urine is lighter. The third or fourth day the swelling subsides, the tenderness of the joint has very nearly gone, and the urine resumes its normal characters. Royer-Collard, from experiencing the benefit of aconite in his own person, strongly recommended it in gout; but the fits, which were once regular, lost this salutary character, and brought on a long train of sufferings, to which the eminent patient at last succumbed. If, as has been supposed, the medicine be chargeable in any degree with this result, it still may be employed locally without a fear of similar consequences.

Neuralgia.—In the treatment of this distressing affection, the benefits to be derived from aconite are unequivocal and precious. It is true that neuralgia is probably a symptom of various, and perhaps in other respects dissimilar, diseases, and is not uniformly cured, nor even relieved, by aconite; but its success is so direct and complete in many cases as to impart to it a decided value. Often it banishes the pain almost instantaneously, as well as permanently; but often, too, it only palliates the suffering of the patient, or puts an end to the present paroxysm without influencing the next. Undoubtedly the cases in which it most signally fails are those in which some previous local malady forms the starting point and cause of the neuralgia. While this remains, no permanent alleviation of the latter disease need be looked for from aconite. Cases illustrative of its anti-neuralgic virtues abound in the periodical literature of the profession. Mr. Curtis[2] reports several cases of immediate and permanent relief from neuralgia of the fifth pair, and of the nerves distributed to the hip and thigh, from the external application of aconite; Tessier[3] several of the same sort cured by aconite given internally; Masius, Rademacher, and others,[4] furnish similar accounts. Imbert-Gourbeyre prefers the inspissated juice of the plant preserved by alcohol, and ascribes to it almost magical powers;[5] and Dr. Stevens, of Cincinnati, reports its success in the cure or relief of "almost the entire range of neuralgic affections, and of those obscure complications of rheumatism and neuralgia in which there is freedom from local or constitutional trouble, inde-

[1] Annuaire de Thérap., 1852, p. 46. Compare, also, ANDREA, Comment. de Re. Nat. et Méd., xvii. 669. BARTHEZ, in his Traité des Maladies Goutteuses, states that he has often seen aconite dissipate the disease even in obstinate cases, and quotes Schenckbucher, Quarin, and Van Swieten to the same purpose.

[2] Lancet, 1840–41, ii. 474. See, also, EADES, Abeille Méd., Oct. 1845.

[3] Bull. de Thérap., xxxiii. 105.

[4] DIERBACH, loc. cit.

[5] Abeille Méd., vii. 21.

pendent of nervous derangement."[1] Gubler has described a very painful affection which this medicine relieved. It is characterized by acute and even intolerable pains in the ends of the fingers and toes. These pains, which are compared to that produced by burning wax, may last for months or even years, and may be followed by gangrene of the part, and the death of the patient by exhaustion. Aconitia, in the dose of half a milligramme ($\frac{1}{130}$ gr.) twice a day, completely suspended the attacks of pain. In another case, probably of gouty origin, the same medicine, in doses three times as large, was equally successful.[2] In *nervous headache*, a closely allied disease, Dr. Burgess states that aconite has been, in his hands, a successful remedy.[3] Dr. Fleming assures us that he has found the topical application of the tincture of aconite extremely serviceable in neuralgia of the intercostal nerves and their spinal branches, or what was once obscurely called *spinal irritation* as well as in neuralgia of the extremities. Of *sciatica*, which is so generally an intractable disease, the same author informs us that he cured permanently seven cases out of twelve; of the remainder, also, two were relieved. Several cases of severe and obstinate neuralgia, of different forms, are reported by Dr. Storer, of Boston, to have been cured by the local use of the tincture of aconite.[4] The best form in which it can be used consists of equal parts of tincture of aconite root and chloroform applied upon a piece of stout cloth to the affected part, and covered with some impermeable substance. Mr. Hilton found the alkaloid aconitia, in an ointment, and in the proportion of two grains to the ounce of lard, competent to suspend violent pains in the ulnar nerve following an amputation of the hand. The same surgeon found very great benefit, in another case, from rubbing this ointment upon the loins and sacrum.[5] Many cases similar to the above are reported by Turnbull, Brookes,[6] Skey,[7] and amongst others by the Reverend and witty Sidney Smith,[8] who says that a certain Mrs. Sibley, who had been "for seven years living in a state of constant agony, and from intensity of pain was often deprived of her reason," had quite recovered under the use of aconitia ointment. The reporter truly and characteristically adds, "She may relapse, but such a holiday in such a complaint is not to be forgotten."

In other painful affections this medicine is often of service. It has been used locally to relieve the various forms of *toothache*, but it should not be intrusted, for this purpose, to unskilled hands. Mr. Curling found a liniment composed of equal parts of soap liniment and tincture of aconite effectual in relieving the severe pain produced by *dry gangrene* of the foot, after various other anodynes had failed.[9] Mr. Long, of Liverpool, ascribes to the tincture a

[1] Cincin. Med. Obs.; and N. Am. Med.-Chir. Rev., ii. 934.
[2] Bull. de Thérap., lxvi. 397.
[3] Lond. Med. Gaz., 1840, p. 765.
[4] Am. Journ. of Med. Sci., July, 1854, p. 100
[5] Times and Gaz., Dec. 1854, p. 614.
[6] Lancet, Jan. 1844, p. 476.
[7] Lond. Med. Gaz., Nov. 1836.
[8] Lancet, Jan. 1838, p. 531.
[9] Times and Gaz., Nov. 12, 1853.

power of preventing the rigor which in certain cases follows the introduction of an instrument into the urethra.[1] In *diseases of the heart* attended by over-action of the organ, Lombard derived benefit from the sedative property of aconite;[2] in *pulmonary* diseases attended by harassing cough and profuse expectoration;[3] in the *purulent diathesis;*[4] in *ulcers* of the limbs, connected with a bad habit of body;[5] in arresting bloody stools in *dysentery;*[6] in *amenorrhœa;*[7] and in *dropsy*,[8] it has also been found useful. Several cases of recovery from *traumatic tetanus* have been reported in which aconite was the principal medicine exhibited. In some the immediate effects of the medicine were such as to render its share in the cure doubtful. But two, of which one was traumatic and the other idiopathic, were treated with aconite by Wunderlich after other remedies had failed. Both cases recovered.[9] The list of diseases for which aconite is alleged to be a palliative or a cure might be greatly extended, but in nearly all the published narratives the proof of its efficacy is far from satisfactory, or, if accepted, only shows it to be inferior to other medicines belonging to the class of narcotics.

Antidotes.—Besides diffusible, and especially alcoholic, stimuli and opium, which have been used with success in poisoning by this drug, strychnia has been employed with advantage.

Administration and Dose.—Aconite may be given in substance, extract, or tincture. Of the *powdered leaves* one or two grains may be used as a minimum dose; of the *extract* from half a grain to one grain; and of the *tincture of the leaves* twenty or thirty drops. But all of these preparations possess inferior qualities to the *tincture of the root*, which should be prescribed in doses not exceeding, at first, three minims, and repeated three times a day. If, as the medicine is continued and the dose greatly augmented, there should arise nausea, numbness, and tingling of the lips, muscular weakness and infrequency of the pulse, it would be prudent to suspend it, and administer stimulants. Sometimes the medicine disagrees with the stomach and bowels, and occasions vomiting and diarrhœa. A small piece of dense sponge, fastened upon a suitable handle, may be used to apply the tincture of aconite externally. The finger would be preferable were it not for the benumbing influence of the fluid upon the skin. It may be used if protected by the finger of a glove.

Aconitia may be applied in an ointment made, according to Dr. Turnbull's formula, of two grains of the alkaloid to sixty grains of lard; or in alcoholic solution, in the proportion of half a grain to one fluidrachm of the menstruum, and the proportion increased until tingling of the skin is produced. This preparation, owing to its uncertain strength and fatal effects in an overdose, ought never to be administered internally.

[1] Liverpool Med.-Chir. Journ., No. 3, p. 28.
[2] Gaz. Méd. de Paris, 1835.
[3] BERTINI, Annuaire de Thérap., 1847, p. 28 et seq.
[4] TESSIER, ibid., p. 22.
[5] GRANTHAM, Ranking's Abstract, 1848, p. 106.
[6] MARBOT, Bull. de Thérap., xxxvii. 105.
[7] WEST, Arch. Gén. de Méd., 2ème sér., viii. 428.
[8] FOUQUIER.
[9] Bull. de Thérap., lxxvi. 477.

PHYSOSTIGMA.—CALABAR BEAN.

History.—Attention was first drawn to the Calabar bean by Dr. Christison, who, in 1855,[1] published an account of its natural history, as then understood, of its uses as an ordeal by the African savages, of some experiments upon animals which he made, and what was of peculiar interest, the effects produced upon himself by a poisonous dose of the bean. The subject does not appear to have attracted the attention it deserved, from that time until 1862, when Dr. Thomas R. Fraser presented a graduation thesis to the University of Edinburgh, on the "Characters, Actions, and Therapeutic Uses of the Ordeal Bean of Calabar."[2] A further and more minute investigation of the physiological action of the Calabar bean was in 1867 published in the Transactions of the Royal Society of Edinburgh, by the same gentleman, to whom we are under obligations for copies of his interesting and ingenious papers.

Description.—Physostigma is the product of *Physostigma venenosum*, the only species of a separate genus, a native of a region of Africa extending westward from the source of the Niger. It grows on the sides and edges of streams, thriving best on swampy river banks. The plant is a perennial creeper, or running vine; the legume or bean is dark-brown and straight, and when mature, about seven inches long. It contains two or three seeds, separated from each other by a woolly substance. The seed or bean, called by the natives Esĕre, is about an inch in length, and in shape "irregular reniform, having the appearance of a somewhat flattened fusiform body bent on one of its edges;" the integument is rather shining, and of a light or dark brown color. This integument is very hard and tough, and the kernel consists of two large concavo-convex cotyledons, of a creamy white color, and easily broken in a mortar or scraped with a knife. They may also be chewed, and have the taste of the edible leguminous seeds, without bitterness, acrimony, or aroma, nor do they make any other impression on the organs of taste and smell; in fact they are scarcely, if at all, distinguishable in taste from ordinary beans. (Christison.)

In 1863 Dr. Fraser separated from the kernel, from the spermoderm of the bean, and also soon after from the excrement of a lepidopterous insect which feeds on the kernel, an amorphous active principle possessing the general properties of a vegetable alkaloid, which he named *Eserinia;* and shortly afterwards, having obtained the alkaloid in, apparently, a state of greater purity, and as a crystalline substance, he gave it the name *Eseria.* Subsequently, by treating the powdered bean with alcohol and then with ether, Jobst and Hesse obtained an oily, brownish-yellow, amorphous substance, which they regarded as an alkaloid, and denominated *physostygmine.*[3] This preparation, however, was shown by MM.

[1] Monthly Journ. of Med., xx. 193.
[2] Edinb. Med. Journ., ix. 36.
[3] Bull. de Thérap., lxvi. 108.

Vée and Leven to be a mixture of several substances, only one of which was crystallizable. The latter experimenters, after exhausting the powdered seed by boiling alcohol, evaporated the solution, and after triturating the residue with tartaric acid, dissolved it in water. An excess of bicarbonate of potassa was then added, and the solution shaken up with ether, and on the evaporation of the latter eseria was deposited. A subsequent solution with ether and spontaneous evaporation of the menstruum determined the deposit of the alkaloid in a crystalline form. The crystals are described as white or slightly reddish, in thin, rhombic lamellæ, soluble in ether and chloroform, but still better in alcohol, and but slightly in water; their watery solution turns reddened litmus-paper blue.[1]

EXTRACTUM PHYSOSTIGMATIS.—*Extract of Calabar Bean.*

Two pints of tincture obtained by percolation from twelve troyounces of powdered Calabar Bean, are reduced by distillation and evaporation to the consistence of a soft extract. *Dose*, about one-tenth of a grain.

Action. *On Animals.*—Scarcely do signs of uneasiness appear, says Dr. Christison, after a fatal dose has been given, when the animal becomes in quick succession languid, prostrate, flaccid, and immovable; respiration, now faint, speedily ceases, and death is complete. Dr. C. also noticed that the paralysis first affected the animal's hinder legs, that the feebleness was attended with slight irregular twitches of the trunk and extremities, the heart of the animal pulsated slowly, feebly, and inefficiently for ten minutes after apparent death, and that the left side of the heart gave out much brighter blood than the right, "showing that the circulation, owing to the paralysis of the heart, had not been maintained after respiration had ceased."

The more recent experiments of Dr. Fraser furnished more definite results than these, and some that were entirely new. After a small fatal dose, a slight tremor seizes the animal, beginning at the posterior regions and advancing forwards; paralysis follows in the same order of parts; the *bowels may be evacuated; and the pupils contract.* Respiration grows stertorous in expiration as well as inspiration, and also slow and irregular. Slight muscular twitches appear, and reflex action is annihilated. Consciousness is preserved as long as life lasts, and while paralysis remains incomplete, signs of sensibility may be elicited. Immediately after death the pupils dilate. On opening the body, muscles which are cut contract; and, in general, muscular contractility is retained for some time after death. The heart acts regularly, and may continue to do so for an hour and a half; the intestines exhibit their vermicular action. The large veins of the thorax are distended, as well as those upon the surface of the brain; the spinal cord appears to be normal as to its supply of blood. The lungs, liver, and kidneys are engorged. When a large fatal dose is given, the right and left sides of the heart and the arteries and veins, which everywhere remain well

[1] Annuaire de Thérap., xxvi. 106; xxvi. 46.

filled, present their characteristic difference of color. The characteristic tremor above referred to may be produced in dogs by the hypodermic injections of one-fifth of a grain of eseria. It is a quivering in which all the muscles, unstriped as well as striped, participate. It varies in degree, being sometimes a slight tremulousness, sometimes a general fibrillary agitation, and sometimes distinct spasmodic movements and even general convulsions may occur.[1] Vomiting is usual; salivation, also, with a frothy bronchial secretion, frequent urination, and fæcal discharges which become more and more liquid.

Dr. Fraser's experiments led him to the conclusion that physostigma occasions death by destroying the power of the spinal cord to conduct impressions, and that the mode of death depends upon the rapidity with which the poison acts. When it acts slowly the result is muscular paralysis, extending gradually to the respiratory apparatus, and producing death by *asphyxia;* when it acts rapidly, the paralyzing action probably reaches the sympathetic system, causing death by *syncope.* The influence does not extend to the brain proper *pari passu* with the action upon the spinal cord. It produces paralysis of muscular fibre, striped and unstriped, both by its action upon the spinal cord, and upon the fibres of the muscles themselves, and acts as an excitant of the secretory system, an effect probably due to a dilatation of the capillary vessels all over the body. The conclusions of Tachau[2] are to the same effect, viz., that the primary action of the poison is upon the heart, and that the disturbance of inspiration is a consecutive phenomenon, due to the imperfect oxygenation of the blood in the lungs. Botkin, also, drew the same inferences from his experiments, viz.: "If the poison is introduced directly into the blood, death ensues from paralysis of the heart; but if the toxical influence is exerted more slowly, as by subcutaneous injection, asphyxia is the cause of death."[3] Roeber, also, concluded[4] that "Calabar bean possesses a special power over the movements of the heart, which in small doses it merely retards, but in large doses completely arrests." It must have been to the last-mentioned class of cases that Dr. Harley alluded, when he maintained that the ordeal bean, "although it may weaken the heart's power, neither stops the circulation, nor arrests the heart's action; it is not, in fact, a cardiac poison."[5] The experiments of Arnstein[6] led him to conclusions of which the following is a summary: Calabar bean does not paralyze the motor ganglia of the heart, nor the sympathetic nerve, nor is the origin of the vagus affected by it, or it is but slightly so. On the other hand, it acts on the peripheral terminations of the vagus, "the incitability of this part is strikingly augmented, and hence may be explained the reduction of the heart's power in poisoning by this substance. When large doses of it are given, the animal dies without

[1] Tison, Tève de Calabar, p. 62.
[2] Archiv d. Heilkunde, 1864, p. 75.
[3] Virchow's Arch. 1866, xxxv. 300.
[4] Practitioner, iii. 117.
[5] Lancet, June, 1863, p. 717.
[6] Würzburg Physiol. Untersuch., 3ttes Heft, s. 106.

paralysis of the vagus. This augmented incitability of the terminal branches of the nerve is due to the direct operation of the poison upon them." So Köhler[1] explains that physostigma does not disorder the heart's rhythm, but rather tends to restore it when it has been deranged by atropia, saponin, etc., and as the cause of such unrhythmical movements depends upon the heart's exhaustion, so physostigma cannot exert a directly debilitating effect upon the heart (?).

The following conclusions respecting the *topical action* of physostigma are those arrived at by Dr. Fraser:—

1. When the poison is applied to the surface of a frog's brain, no effect is produced; but when it is brought into contact with the spinal cord, a few twitches occur in the extremities, followed by paralysis of the portion of the cord acted upon.

2. When physostigma is applied to a mixed nerve trunk in a concentrated form, and with proper precautions to prevent absorption by neighboring parts, first the afferent nerve fibres are paralyzed, and afterwards the efferent.

3. Topical application destroys the contractility of striped and of unstriped muscular fibre. The heart's action is stopped by repeated application to its external surface, or to the pericardium. If a small quantity be injected into one of its chambers, paralysis nearly immediately follows.

4. The bloodvessels are dilated when a solution is applied to the web of the frog's foot.

The action of physostigma upon the eye will be more conveniently studied in connection with its operation in man.

On Man.—The ordeal bean is so called because it is used by the barbarous negroes of the Calabar coast, and other parts of Africa, to determine the innocence or guilt of persons accused of witchcraft and other crimes, precisely as the ordeal by fire, by water, and by various other agents, was resorted to for the same purpose in Christian countries until within a very recent period. The following account of the trial is taken from the narrative of Rev. W. C. Thomson, a missionary in Calabar: "The suspected person has some entire beans handed to him, which he is compelled to eat. Meanwhile others are bruised, and being well mixed with water, one part is taken as a draught, and the rest administered as an enema. If after vomiting and purging, the person recovers, he is declared innocent; if not, he is pronounced guilty." In one case, which is a counterpart of several others, an adult female "ate up several beans quite deliberately, taking an occasional sip of water to facilitate deglutition. In a little more than half an hour afterwards she was perfectly helpless. She was sitting on the ground, supported by a female friend, who sat on a low stool behind her. She seemed to be perfectly flaccid. Her back was much bent backwards, and her legs thrust out flat on the ground before her. She complained of intense nausea; there was a constant flow of mucus;

[1] Archiv für exp. Path. u. Pharm., i. 298.

occasionally an attempt to vomit, when small quantities of mucus were thrown up. In a few hours she was dead."[1]

The number of cases of poisoning by the Calabar bean is very small indeed, owing, no doubt, to the very limited supply of it in commerce; and among these, so far as we are informed, one only proved fatal, and that was a boy already debilitated by advanced phthisis. It appears that in August, 1864, a crowd of children ate some beans which they found among the rubbish deposited upon waste ground near Liverpool, and which consisted of the sweepings of a ship that had recently brought a large quantity of Calabar beans from Africa. Forty-six of the children were admitted into the Southern Hospital. Their most prominent symptom was loss of muscular power, and a state of prostration characterized by a feeble, slow pulse, a cold, perspiring skin, and cold extremities, in fact a condition resembling the collapse of cholera. Vomiting was present in nearly all of the cases, and diarrhœa in about one-third of them. Pain, like that of colic, was said to have been felt at the commencement of the illness, but subsequently there was a remarkable freedom from suffering. In a proportion, not stated, the pupils were contracted. In one case, they were observed to be contracted during sleep, but dilated when the patient was aroused by galvanism, or merely by shaking him. In no case was there any form of convulsion. The boy who died, and who was nearly seven years old, is stated to have eaten six beans when his stomach was empty. He staggered as he walked, and then fell, kicking and rolling as if in pain, but he afterwards became quiet. He could not hold up his head, and he complained of a heavy weight at the chest. His pupils were not contracted. He was much purged; his pulse barely perceptible; the respiration rattling; the skin cold, and the face livid. He was quite conscious, and able to swallow water. Directly after drinking he died without a struggle, some froth at the time issuing from his nose and mouth. On dissection, the body presented no peculiar appearances belonging to the poisoning, except a fluid condition of the blood, which also distended the heart, whose muscular structure was very flaccid. The mucous membrane of the stomach was of a pale pink color.[2] Cases which terminated favorably have been reported by Dr. Fraser and Mr. Young.[3] In all of them abdominal pain was complained of.

Such a degree of poisoning as that last referred to was experienced in his own person by Dr. Christison, who has furnished a most interesting narrative of his condition and sensations,[4] which we transcribe without abridgment:—

"Having some doubts whether I had obtained the true ordeal poison, as it tasted so like an eatable leguminous seed, I ate one evening the eighth part of a seed, or six grains, about an hour after a very scanty supper. During an hour that I passed in bed, read-

[1] Edinb. Journ., xii. 1002. [2] Times and Gaz., Oct. 1864, p. 406.
[3] Edinb. Journ., ix. 131; Ibid., x. 192.
[4] Month. Journ. of Med., March, 1855, p. 201.

ing, I could observe no effect whatever, and the next morning I could still observe none. I am now satisfied, however, that a certain pleasant feeling of slight numbness in the limbs, like that which precedes the sleep caused by opium or morphia, and which I remarked when awake for a minute twice or thrice during the night, must have been owing to the poison.

"On getting up in the morning I carefully chewed and swallowed twice as much, viz., the fourth of a seed, which originally weighed forty-eight grains. A slight giddiness, which occurred in fifteen minutes, was ascribed to the force of the imagination, and I proceeded to take a warm shower-bath, which process, with the subsequent scrubbing, might take up five or six minutes more. The giddiness was then very decided, and was attended with the peculiar, indescribable torpidity over the whole frame, which attends the action of opium and Indian hemp in medicinal doses. Being now quite satisfied that I had got hold of a very energetic poison, I took immediate means for getting quit of it, by swallowing the shaving-water I had just been using, by which the stomach was effectually emptied. Nevertheless, I presently became so giddy, weak, and faint, that I was glad to lie down supine in bed. The faintness continuing great, but without any uneasy feeling, I rang for my son, told him distinctly my state, the cause, and my remedy—that I had no feeling of alarm, but that for his satisfaction he had better send for a medical friend. Dr. Simpson, who was the nearest, reached me in a few minutes—within forty minutes after I ate the seed—and found me very prostrate and pale, the heart and pulse extremely feeble and tumultuously irregular; my condition altogether like that of profuse flooding after delivery; but my mental faculties quite entire, and my only sensation that of extreme faintness, not, however, unpleasant.

"Dr. Simpson judged it right to proceed at once for Dr. Douglass Maclagan as a toxicological authority, and returned with him in a very few minutes. In his absence, feeling sick, I tried to raise myself on my elbow to vomit, but failed. I made a second and more vigorous attempt, but scarcely moved. At once it struck me —'This is not debility, but volition is inoperative.' In a third effort I was more nearly successful, and in the fourth, by a resolute exercise of the will, I did succeed, but I could not vomit. The abdominal muscles acted too feebly; nor were they much aided by a voluntary effort to make them act. I then gave up the attempt, and fell back, comforting myself with the reflection that vomiting was unnecessary, as the stomach had been thoroughly cleared. At the same time the sickness ceased, and it never returned. There were now slight twitches across the pectoral muscles. I also felt a sluggishness of articulation, and to avoid any show of this, made a strong effort of the will to speak slowly and firmly, through fear of alarming my son who was alone with me. Dr. Maclagan, on his arrival, thought my state very like the effects of an over-dose of aconite. Like Dr. Simpson, he found the pulse and action of the heart very feeble, frequent, and most irregular; the countenance

very pale, the prostration great, the mental faculties unimpaired, unless it might be that I felt no alarm where my friends saw some reason for it. I had in fact no uneasy feeling of any kind, no pain, no numbness, no prickling, not even any sense of suffering from the great faintness of the heart's action; and as for alarm, though conscious that I had got more than I had counted on, I could also calculate that if six grains had no effect, twelve could not be deadly when the stomach had been so well cleared out. Presently my limbs became chill, with vague feeling of discomfort. But warmth to the feet relieved this, and a sinapism over the whole abdomen was peculiarly grateful when it began to act. Soon afterwards the pulse improved in volume but not in regularity. I was now able to turn in bed, and happening to get upon the left side my attention was for the first time directed to the extremely tumultuous action of the heart, which compelled me to turn again on the back to escape the strange sensation. Two hours after the poison was swallowed I became drowsy, and slept for two hours more; but the mind was so active all the while that I was not conscious of having been asleep. On awaking, the tumultuous action of the heart continued. In an hour more, however, I took a cup of strong coffee; after which I speedily felt an undefinable change within me, and on examining the condition of the heart, I found it had become perfectly and permanently regular. For the rest of the forenoon, I felt too weak to care to leave my bed; and on getting up after a tolerable dinner, I was so giddy as to be glad to betake myself to the sofa for the evening. Next morning, after a sound sleep, I was quite well."

Most of the symptoms enumerated in this description have been noted by other observers, and especially by Dr. Fraser, who moreover experienced dimness of vision and dizziness, and an accumulation of fluid in the mouth. The epigastric sensation he describes by saying, that "it resembles the unpleasant feeling which is produced when a piece of solid food of too large a size is suddenly 'bolted.'" It may, perhaps, be attributed to the topical paralyzing influence of the poison. The action of *eseria* may be inferred from an experiment of Leteinturier, who took about one-fifth of a grain of this substance. The symptoms were "indistinctness of vision, vertigo, nausea, relaxation of the muscles, vomiting, heaviness of the head, coolness and dryness of the skin, a slow pulse, myopic vision, and contracted pupils."[1] Except the gastro-intestinal derangement, all the usual symptoms produced by Calabar bean were present in this experiment.

The muscular weakness which is the most prominent effect of physostigma is not, perhaps, to be easily explained, especially in view of the direct paralyzing operation of the poison upon certain organs, unless it is produced by the immediate contact of the poison in the blood with the nervous extremities. But, in that case, it is not apparent why the muscles of the neck and upper

[1] TISON, Fève de Calabar, Paris, 1873.

limbs should not be weakened to the same degree as those of the lower limbs, nor at the same time as they are. In all of the dissections made of animals killed with physostigma, the spinal cord has presented no lesion whatever, either of vascularity or of the nerve tissue; and therefore the nature of its share in the phenomena we have been considering, can only be inferred from physiological experiments. But they, while demonstrating the part which "the spinal cord, as a reflex-centre," takes in these phenomena, do not illustrate the nature of its influence, nor the molecular or other physical changes, if any, that take place in it. Nor, while the direct local action of the poison upon muscular contraction is known, do they prove that in the arrest of the heart's movements, the spinal marrow is the sole channel of the inhibitory influence under which they cease. Indeed, when we consider that if the tincture or extract is applied to the skin, "a distinct diminution of the sensibility occurs, and the skin may be pricked, very little pain only being excited" (*Fraser*), we are rather inclined to the opinion that the whole chain of toxical phenomena occasioned by this substance, is more readily explained by its immediate action upon the muscles, or upon the nervous branches which supply them, than by its operation upon the spinal axis.

This conclusion, if we are not greatly mistaken, is supported by the effects which are produced by a direct application of physostigma *to the eye*. "When," says Dr. Fraser, "the extract is applied to the eyeball, it immediately causes a copious secretion of tears, and in about five minutes a distinct contraction of the pupil, *confined to the side of application*. In about thirty minutes after the application the pupil becomes a mere speck, but still retains a certain degree of mobility. It continues in this state for twelve or fourteen hours, but a greater or less contraction of the pupil may persist for five or six days. A slight headache and dimness of vision, with myopia on the affected side, are almost always produced, but these only continue for one or two hours at the commencement. When the extract is applied to the edges and outer surface of the eyelids, there is produced, in addition to the contracted pupil, a degree of immobility of the eyelids. No effect was produced on the pupil by friction on the temples or over the eyebrows with any preparation of the kernel." These effects, the author believes, may be "intelligibly explained by the universal relaxation of all the contractile tissues of the iris, and the consequent enlargement of its area by the increased accession of blood, which the dilated vessels attract and permit." The topical action of physostigma on the bloodvessels certainly supports the view just stated; and although Dr. Fraser thinks that it does not "seem so certainly supported by further experience as to permit of its reassertion," it remains, upon the whole, the most consistent judgment which has yet been pronounced upon the question.

The conclusions of other experimenters and observers may be represented by the following examples: Dr. Robertson[1] attributes

[1] Edinb. Journ., viii. 819.

the phenomenon to an "increased action of the sphincter pupillæ,' and concludes that "the Calabar bean is a stimulant of the ciliary nerves." Von Graefe[1] asserts that "the disorder of accommodation is a real spasm of the muscular apparatus which produces it." Dr. Soelberg Wells[2] says, that the medicine "causes contraction of the pupil and also of the ciliary muscles," thus changing the normal into the short-sighted eye. Warlomont[3] considers that it "acts on the sphincter of the iris by irritation, causing a spasmodic action of the third pair." Dr. E. Watson[4] assumes that "its action must be on the nerve," and proceeds to speak of its action when "it comes to affect the lower segment of the spinal cord of the neck," etc., whereas it is admitted on all hands, and even by himself, that "the effect on the eye is not nearly so great or so long continued when the bean is administered generally as when it is applied locally to the eye." Such is, indeed, the fact, and Dr. Fraser has shown that the poison penetrates the anterior chamber of the eye, for by removing the aqueous humor and placing it on the conjunctiva of another animal, the usual effects of Calabar bean on the pupil will be produced. The theory that this agent occasions contraction of the pupil only by its local action in paralyzing, dilating, and congesting the bloodvessels of the iris, is in perfect harmony with that which ascribes to belladonna a power of dilating the pupil by producing a constriction of the same bloodvessels;[5] while, on the other hand, the opinion that it causes contraction of the pupil by stimulating the muscles of the iris, is too improbable to command belief, in view of the fact that the peculiar action of the poison, from first to last, and in every grade of its operation, is to paralyze the involuntary as well as the voluntary muscles, the striped as well as the unstriped. It is true that some experimenters have concluded that "the increase of defecation observed in poisoning with Calabar bean is the result of a tetanus of the stomach and intestines" (*Roeber*); but such an effect upon the intestinal muscles while all the others are in a state of extreme relaxation is too extraordinary to be accepted upon such evidence as has hitherto been produced.

According to Rossbach & Fröhlich very minute doses of atropia cause contraction of the pupil, while very large doses of physostigmin dilate the pupil. Thus, "the action of both alkaloids on the pupil is exactly alike. Small doses of both cause contraction; large doses cause dilatation." These authors also find "that atropia in certain doses will remove the contraction caused by physostigmin, but that the latter drug cannot remove the dilatation caused by atropia."[6]

Uses. *Diseases of the Eye.*—The power of physostigma to produce contraction of the pupil naturally suggested several uses of it in ophthalmic medicine, which were first pointed out by Dr. Fraser, as

[1] Archives Gén., 6ème sér., ii. 310.
[2] Lancet, June, 1862, p. 717.
[3] Boston Journ., Jan. 1864, p. 509.
[4] Edinb. Journal. xii. 1012.
[5] Compare T. Wharton Jones, Times and Gaz., July, 1864, p. 111.
[6] Am. Journ. of Med. Sci., April, 1874, p. 525.

follows: "In *mydriasis*, whether dependent on the over-action of belladonna, or as a symptom of amaurosis, especially the hydrocephalic variety; in the treatment of *iritis*, and of inflammation of neighboring structures, where the prevention of adhesions may be more successfully secured by an alternation of contraction with dilatation than by dilatation alone; in all cases in which a change in the position of the iris is indicated, as in *injuries of the eyeball* with displacement of the iris," etc. These, in fact, are all conditions of the eye in which physostigma has been profitably employed. Mr. Neill, of Liverpool, has reported a case of dilated pupil with confused vision, the result of a blow on the eye with a stone, which was greatly benefited by this medicine applied to the eye,[1] and many similar ones might be referred to. But this is unnecessary, since the power of the medicine is limited to its contracting the pupil, and modifying the power of accommodation of the eye. Evidently the integrity of the nervous organ of vision is an essential condition of the usefulness of physostigma in such cases. Its degree of usefulness will also be much greater in recent than in confirmed disorders of vision depending upon the dilated pupil, and derangements of the accommodative and refractive power. *Prolapse of the iris* may be prevented or remedied by this agent, when it occurs near the margin of the cornea. Cases of the complete success of this method have been published by Mr. Nunneley,[2] and others. *Adhesions of the iris*, both posterior and anterior, have been successfully broken up by employing physostigma and atropia alternately, so as by turns to contract and dilate the pupil. The operation of *iridectomy* is singularly facilitated by the tension and increase of surface which the iris, under the influence of this agent, presents.

Tetanus.—The extreme muscular relaxation produced by poisonous doses of Calabar bean naturally led to its trial in this disease, and the results appear, to a certain extent, to have confirmed the expectation of its usefulness. The first case was one of traumatic trismus, in which it does not seem to have done any good,[3] although the patient recovered in spite of a somewhat miscellaneous medication. Afterwards, in a case of fully developed tetanus, it was used by Dr. E. Watson, until the full production of its characteristic effects. It completely controlled the spasms, and ultimately accomplished a cure. In a second case of traumatic tetanus, with tetanic fits and opisthotonos, five minims of the tincture of the bean were administered every hour. Each dose had a perceptible effect in relaxing the rigid muscles, and in diminishing the susceptibility to the induction of spasms. In three days the patient was able to sit up in bed, and in seven days more he was out of bed, walking, though stiffly, through the ward. In a few days more he was perfectly well.[4] A case is reported[5] by Dr. A. Campbell, also, of traumatic origin, in which the symptoms began to be

[1] Times and Gaz., May, 1863, p. 491.
[2] Lancet, July, 1863, p. 65.
[3] Ibid., March, 1864, p. 348.
[4] Ibid., March, 1867, p. 265; Edinb. Journ., xii. 1022.
[5] Lancet, Aug. 1867, p. 157.

developed two months after the injury was received. When the treatment was commenced the characteristic symptoms of the disease were present in an aggravated form. A solution of twelve grains of the extract of physostigma was used, of which five drops, or about one-eighth of a grain, were given every half hour; but on the following day eight drops were given every two hours. When the patient had taken, in all, about six grains, she became half comatose, the pupils were considerably contracted, the breathing more easy, the tendency to opisthotonos ceased, and the muscles of the extremities were quite relaxed. From this time there were no spasms unless the patient was moved; and the medicine, which had been suspended, was resumed in diminished doses, and continued until full convalescence. In a case of idiopathic tetanus in a child of thirteen years, which also terminated in cure, the powdered bean was administered to the extent of eleven and finally of fifteen grains in twenty-four hours,[1] and although it did not produce contraction of the pupil, and although a share in the cure must be attributed to a constant diaphoresis maintained by heat, we cannot but regard the issue as mainly due to the internal medicine. Dr. Fraser, calling attention to the power of physostigma in diminishing the reflex activity of the spinal cord and in neutralizing the tetanic symptoms produced by strychnia in frogs, refers to eleven cases of traumatic tetanus out of which there were nine recoveries under the use of this medicine. He recommends its administration hypodermically, in the dose of about one-third of a grain of the extract mixed with ten or fifteen minims of water.[2] Dr. Joseph F. Edwards,[3] from an analysis of published cases, finds that out of sixty-four cases of traumatic tetanus treated with physostigma thirty-three recovered; a proportion of cures of this formidable disease which is not exceeded by the results of any other treatment of it whatever.

A remarkable case of *tonic convulsion*, which persisted for many months, the fits recurring several times a day, is reported by Dr. Mac Laurin.[4] There was no loss of consciousness, but rigidity of the limbs, the head being drawn towards the left shoulder, and twitching of the features of the same side. Every remedy was fully tried, but in vain, and the condition of the patient was growing steadily worse, when it was determined to employ physostigma. The dose was gradually increased until the equivalent of four grains of the bean was taken three times a day. It reduced the pulse temporarily to fifty-eight, and excited the gastric uneasiness which is peculiar to its operation; but the pupil remained unaffected. From the first the patient slept better at night; then the intervals between the paroxysms became longer, and the attacks less severe, until, at the end of five or six weeks, they ceased altogether. This very remarkable success, in an affection apparently beyond the

[1] Bull. de Thérap., lxvii. 79.
[2] Practitioner, i. 76.
[3] Inaugural Essay, Univ. of Penna., 1874.
[4] Edinb. Journ., xi. 319.

hope of cure, cannot fail to induce physicians, who may have similar cases under their care, to give the new remedy a fair and extensive trial of its singular powers. In another case, also reported by Dr. Mac Laurin, a little girl aged four years and six months, who had had convulsions four or five times every day for about nine months, not a single recurrence of convulsion took place after the first dose of the medicine was taken.[1]

It is only natural that this agent should be employed to counteract the effects of *poisoning by strychnia*. The experiments upon animals performed by Dr. E. Watson certainly prove that both poisons cannot produce their specific effects at one and the same time, and that each counteracts the influence of the other, provided that their doses and the time of their administration are duly adjusted. According to Dr. Fraser, the success of Calabar bean in strychnia poisoning will probably depend on the quantity of strychnia, in relation to the case, that has been administered, and on death being threatened by asphyxia or exhaustion. M. Vée, on the other hand, maintains that eseria is not an antidote to strychnia, and that it does not avert death, but only changes the mode of death.[2] We are not acquainted with any case in which physostigma, or its active principle, has been used in the treatment of strychnia poisoning, and consequently the true ground for deciding the question is still wanting; but certainly the results which have been given above of the use of the remedy in tetanus are sufficiently conclusive to justify its trial as an antidote to strychnia.

Although the remedies for *chorea* have been generally found among those which stimulate and fortify the nervous system, the power of physostigma over muscular movements could not fail to suggest its application to this disease. The results of the experiment have been encouraging. The first case in which the treatment by this medicine was reported[3] was one that had proved intractable to the usual methods, but recovered rapidly when it was administered in the dose of one grain three times a day. No unpleasant effects of any kind were produced. Several equally successful cases occurred in the practice of Dr. Ogle.[4] But when it was employed systematically by Dr. Fuller, he was forced to conclude that it did not exercise the slightest influence over the disease.[5]

In two cases of *poisoning by atropia* occurring at the same time, Dr. Kleinwächter gave to one of the patients a full dose of the extract of physostigma, but none to the other patient who was less violently affected. In a few minutes the dose produced violent vomiting, the furious delirium subsided, consciousness returned, and the pupils became somewhat contracted. In the other case no

[1] Lancet, Sept. 1865, p 376. [2] Annuaire de Thérap., xxvi. 51.
[3] Lancet, Sept. 1855, p. 376.
[4] Times and Gaz., Sept. 1865, p. 256; and Jan. 1866, p. 36.
[5] St. George's Hosp. Rep., v. 13.

improvement was manifested for forty-eight hours.[1] Commenting upon this example, Dr. Fraser remarked, that the nature of the effects of physostigma and atropia on the cerebro-spinal system is such as to make it irrational to anticipate any success in their employment as counter agents. More recently, however, Dr. Fraser, in a series of elaborate experiments,[2] has shown that atropia possesses in a remarkable degree the power of counteracting the lethal action of physostigma. He proved experimentally that the fatal action of a dose of physostigma equal to or greater than the minimum lethal dose, is prevented by the physiological action of a non-lethal dose of atropia. "The one substance counteracts the action of the other; and the result is a physiological antagonism so remarkable and decided, that the fatal effect even of three and a half times the minimum-lethal dose of physostigma may be prevented by atropia."

The foregoing remarks have been justified by experiments performed upon himself and others by Dr. Charles G. Frowert.[3] In one experiment upon himself Dr. Frowert employed atropia subcutaneously after the full development of the effects of physostigma; the latter phenomena immediately began to subside. In a second experiment he took eight grains of extract of physostigma (a dose which he had proved sufficient to develop the full effects of the drug), and at the same time by subcutaneous injection one-thirtieth of a grain of sulphate of atropia. The characteristic symptoms of physostigma failed almost entirely to appear, but the pupils became dilated. In two other cases the question was tested: in one four grains of extract of physostigma were administered to an adult male, and its appropriate effects developed in a marked degree; a few days afterwards he received a similar dose, and at the same time one-thirtieth of a grain of sulphate of atropia hypodermically, which effectually prevented the development of the effects of the original poison. To another adult male four grains of extract of physostigma were given, producing the usual phenomena. When at their height "one-thirtieth of a grain of sulphate of atropia was hypodermically injected. In fifteen minutes the man felt much relieved, the colic was less severe, the pulse 69, and the pupils dilating. In thirty minutes he was well enough to take a light meal. There remained, however, for several hours, a slight paralysis of the lower extremities, which finally disappeared with complete recovery."

The anæsthetic action of physostigma, says Dr. Fraser, "may be applied to the treatment of all *nervous irritations.* I have employed it with great advantage in various neuralgic affections, and in irritable stomach. It probably acts by producing a local change in the nerves of the affected region, which interferes with their power

[1] Brit. and For. Med.-Chir. Rev., Jan. 1865, p. 237.

[2] On the Antagonism between the Actions of Physostigma and Atropia, Edinb., 1872.

[3] Inaugural Essay on the Physiological Antagonists of Physostigma, University of Pennsylvania, 1874.

of receiving or conducting impressions. That it does not depend on any constitutional action of the kernel appears probable, from the absence of any appreciable constitutional symptom." As an illustration of the anodyne influence of the medicine, a case of *lumbago* is related, in which frictions of the loins with tincture of physostigma afforded complete relief. In this respect, as in some others, the action of the medicine resembles that of aconite. In several cases of *neuralgia* its local anodyne effects were distinctly manifested, and its internal administration was followed by marked alleviation of the neuralgic pain produced by malignant and also by fibrous tumors of the uterus. Thus, indirectly, the medicine may be usefully employed as a *hypnotic*.

When the poisonous effects of physostigma have been developed, they should be counteracted by coffee and alcoholic stimulants, if the patient is able to swallow; and, if he cannot, respiration should be assisted by cleansing the fauces of mucus, and by artificial respiration excited by mechanically compressing and dilating the thorax. Induced electricity should also be applied between the phrenic nerve in the neck and the attachments of the diaphragm to the ribs. Rubefacients and mechanical stimulants of the skin ought not to be neglected. Belladonna and atropia may also be used as efficient counter-poisons.

Administration.—About *one grain* of the powdered bean may be employed as a commencing dose. The officinal *extract* may be prescribed in the dose of one-tenth of a grain. There is a *fluid extract* of which one part represents four of the bean. Dr. Fraser proposed a *tincture* prepared by percolation so as to produce two ounces of tincture from an ounce of the powdered bean. Of this the average dose is about *five minims*. A *tincture* is used in this city, prepared so as to produce a pint of tincture from two ounces of the bean. Its dose is *twenty drops*. The active ingredients in the doses mentioned of the two tinctures are nearly the same.

CONII FOLIA.—Conium Leaves.

CONII FRUCTUS.—Conium Seed.

Description.—The leaves and seeds of *Conium maculatum* are officinal, but the whole plant contains a peculiar principle, *conia*, on which its medicinal activity depends. Conium is a plant of the natural odor of umbelliferæ; and is a native of Europe, but is naturalized in the United States. It bears a general resemblance to parsley, has a white, fleshy, fusiform root, and an erect, herbaceous, and branching stem, from three to five feet high, smooth, and of a bright green spotted with purple, whence the name *maculatum* applied to the plant. The leaves are pinnate, with incised leaflets of a deep green color above, but paler below. The flowers are white, disposed in numerous compound terminal umbels, and the

seeds, or fruit, are double, of an ovate form, the two portions adhering by the base, and are ribbed longitudinally on their convex surface.

The whole plant exhales a strong and fetid smell, which has been compared to that of musk, of copper, of mice, and of cat's urine.

Conia, when pure, is a yellowish, oily-looking, transparent liquid, lighter than water, of a penetrating smell, resembling the combined odors of tobacco and mice, and of an acrid, nauseous, and tobacco-like taste. It is very volatile, is slightly soluble in water, but less in warm than in cold water, and readily dissolves in alcohol, ether, and fatty and essential oils. Its reaction is alkaline, and with acids it forms combinations which crystallize with difficulty, and are very soluble in water, and extremely poisonous.

The following preparations of conium are officinal:—

EXTRACTUM CONII.—*Extract of Conium.*

It consists of the juice of fresh conium leaves reduced by gentle evaporation to a proper consistence.

EXTRACTUM CONII ALCOHOLICUM.—*Alcoholic Extract of Conium.*

It is made by exhausting powdered conium leaves with alcohol by percolation and evaporating the product to a proper consistence by a gentle heat.

EXTRACTUM CONII FRUCTÛS FLUIDUM.—*Fluid Extract of Conium Seed.*

It is procured by exhausting sixteen troyounces of powdered conium seeds in a percolator with a mixture of glycerin and alcohol, to which muriatic acid is added, and evaporating, at a moderate temperature, to the production of one pint of tincture.

TINCTURA CONII.—*Tincture of Conium.*

It is made by percolation with four troyounces of powdered hemlock and alcohol so as to produce two pints of tincture.

Medical History.—Conium or hemlock was well known in ancient times, although it does not appear to have been used as an internal medicine until very recently. It is familiar to scholars as the agent of certain governments for destroying political offenders, and, indeed, the clearest description of its effects that has reached modern times is contained in the narrative of its most illustrious victim's death. "Socrates, after swallowing the poisoned cup, walked about for a short time as he was directed by the executioner; when he felt a sense of heaviness in his limbs he lay down on his back; his feet and legs first lost their sensibility, and became stiff and cold; and this state gradually extended upwards to the heart, when he died convulsed."[1] This description contains substantially the symptoms ascribed by Dioscorides[2] to poisoning by hemlock, viz., vertigo, confused vision, hiccup, disturbance of the

[1] ADAMS, Comment. on Paulus Ægineta, ii. 212; Lancet, 1837, p. 612.
[2] Lib. vi. cap. xi.

mind, cold extremities, and at last convulsions. Paulus Ægineta adopts this account literally, but Nicander adds to it "a sense of suffocation."

Many doubts have been entertained whether the Athenian state poison was in reality conium, and not some variety of cicuta, but several considerations appear to sustain the more commonly received opinion. On the one hand, the failure of conium and its preparations to produce poisoning, or, indeed, any sensible phenomena, only proves that they who witnessed such failures must have experimented with an inert substance; and, on the other hand, the stronger the preparation of the drug employed by other experimenters the more nearly did the phenomena resemble those recorded above. Dioscorides himself also declares that the powers of the plant differ very much according to its locality, and he mentions Athens as one of the places where it is most powerful, and Matthiolus states as a notorious fact that the Italian is inferior to the Greek conium.[1] A modern writer, Dr. Sibthorp, found *C. maculatum* growing most abundantly between Athens and Megara, but neither *Cicutu virosa* nor other analogous plants, whose effects might be mistaken for those of the spotted hemlock, were to be discovered in that region.[2] It may be added that this plant is called κώνειον by the modern Greeks, and that the discutient and sedative virtues ascribed to conium in modern times were also thought by ancient writers to belong to it.

It appears that, as different localities in Greece produced conium of unequal degrees of strength, so, in general, that which grows in the northern countries of Europe is very much feebler than the southern plant. This circumstance must be added to the others which explain the want of uniformity in the results of experiments made to test the virtues of conium, and the conflicting opinions respecting it of authors both ancient and modern.

Dioscorides directs that the juice should be obtained from the stalks and seeds before they are withered, and that it should be dried *in the sun.* This latter direction is of importance, for a very moderate degree of artificial heat decomposes and drives off the conia which they contain. The same author recommends conium as an anodyne for all pains, and as useful in erysipelas and phagedenic ulcers. The bruised plant he directs to be applied upon the genitals as a remedy for nocturnal pollutions, and upon the breasts of girls to prevent the development of these organs. Pliny makes almost identical statements, and Avicenna and Serapion propose a hemlock plaster to resolve tumors of the mammæ and testicles, and to restrain the secretion of milk.[3] In more modern times, several authors, among whom may be mentioned Ettmüller, Paré, Ray, and Lemery, extol this plant, especially when bruised and applied in the fresh state to scirrhous and other tumors. Rénéaulme, a physician of Blois, gave it internally to remove visceral "obstructions."[4] Wyer,

[1] Comment., lib. iv. cap. 74.
[2] PEREIRA; MÉRAT et DE LENS.
[3] BAYLE, op. cit., iii. 559; MURRAY, op. cit.
[4] SPRENGEL, Hist., etc., v. 475.

de Heers, and Rathlaw, in the seventeenth and eighteenth centuries, employed conium in venereal and other cutaneous affections, but it was not until Stoerck, in 1760, published his treatise on the subject that it was much used as an internal remedy, nor were all the advantages known that could be derived from its external use. In the first essay of the author just named numerous cases are reported of scirrhous tumors, chronic abscesses, and ill-conditioned ulcers cured by extract of conium, and in the second he affirms its power of removing cancer. This exaggeration of its merit caused a reaction of professional opinion against the remedy, and after enjoying for many years an almost unlimited popularity, it was proved to be nearly valueless in cancerous affections, and it therefore came to be neglected even in diseases in which it is really efficacious. Of late years the profession has to some extent recovered from the unjust prejudice entertained against the medicine, for it cannot be denied that such evidences of its curative virtues abound as entitle it to a prominent place in the materia medica.

Action. *On Animals.*—Some animals, it is said, such as the sheep and goat, can browse on conium without injury, but others are more or less affected by it. Rabbits and horses seldom experience mischief from its use; a horse took three pounds and a half of the plant without inconvenience, yet to another one a decoction of four ounces proved fatal.[1] It caused dejection, stupor, dilatation of the pupils, trembling, salivation, nausea, spasmodic contraction of the muscles of the extremities, rolling of the eyes, grinding of the teeth, and copious cold sweats. Dr. Harley relates that sixteen ounces of conium juice, "equivalent to a pound of the fresh leaves," were given to a horse with the following effects: pendent head; swollen and drooping eyelids; a dull, heavy appearance; unsteady and stumbling gait; the pulse and pupils unchanged.[2] It is related that asses which feed upon the plant fall into so deep a stupor that they have been taken for dead, and even half flayed before the mistake of the operators was discovered.[3] Oxen, wolves, and dogs are said to be easily affected by conium, but dogs, because they vomit readily, generally escape with their lives, although they may remain tremulous for several days.[4] Dr. Christison is of opinion that conium does not destroy sensibility, but by paralyzing the muscles of expression prevents the subject of experiment from betraying any outward sign of distress. The toxical phenomena are recorded by him in the following order: Paralysis of the voluntary muscles, with occasional slight convulsions, then paralysis of the respiratory muscles of the chest and abdomen, and finally cessation of the action of the diaphragm.

Conia acts with vastly more energy than conium, and differently in some respects. According to Geiger's and Christison's experiments, it is a deadly poison for all species of animals.[5] Applied

[1] PEREIRA, Mat. Med.
[2] Old Vegetable Neurotics.
[3] MATTHIOLUS, loc. cit.
[4] GIACOMINI, op. cit.
[5] DIERBACH, Neueste Entdeckungen, i. 278.

directly to the peritoneum or the conjunctiva it causes vascular injection, and upon all sensitive parts it produces signs of pain. But these local symptoms are speedily obscured by signs of general poisoning, which consist essentially of those detailed above, viz., a rapidly increasing paralysis first of the voluntary muscles, then of the respiratory muscles of the breast and abdomen, and finally death by asphyxia, or, as Van Praag expresses it, by "paralysis of the spinal marrow."[1] According to some experimenters, the heart beats strongly even when voluntary motion, respiration, and all other signs of life are extinct. After death, it contains dark-colored blood in its left cavities. The external senses retain their activity almost perfectly, and even volition is preserved until the last breath. Drs. Brown and Fraser, alluding to these experiments, and to the later ones of Kölliker and Guttmann, remark: "From the results obtained by these authors, it is now certainly established that this alkaloid is a poison of great activity, and that it produces marked paralytic and less obvious spasmodic symptoms. The former symptoms have been shown to depend principally on an action on the peripheral terminations of the motor nerves; but the causation of the latter is yet unknown. It has also been ascertained that conia does not directly influence the functions of the sensory nerves, striped muscles, or heart." Drs. Brown and Fraser concluded from their experiments with conia upon frogs, that in relatively small doses it first produces paralysis of the motor nerves, and subsequently of the reflex function of the spinal cord; but that in relatively large doses it first occasions paralysis of the reflex function, in these animals.[2] Damourette and Pelvet,[3] in their exhaustive experimental treatise upon this subject, arrived at conclusions essentially identical with those above stated; but they also claim to have demonstrated that conia occasions a destructive alteration of the red blood-disks. They state that in poisonous doses it prevents the coagulation of the blood, rendering it dark and fluid; and they suggest that it is probably a degree of this action which has laid the foundation for the belief, which has so generally prevailed, in the utility of conium in chronic rhumatism, diseases of the skin, scrofula, and even cancer. It should be mentioned, on the other hand, that Verigo maintains "that the blood does not appear to undergo any alteration, the corpuscles at any rate retaining their capability of absorbing oxygen."[4]

No poison, except prussic acid, excels conia in the subtlety and rapidity of its operation. A drop placed on the eye of a rabbit killed it in nine minutes; by a like application of three drops, a strong cat was destroyed in a minute and a half; and five drops, placed in the gullet of a small dog, caused its death in one minute. Introduced into the veins, the fatal effect was almost instantaneous.

[1] Journ. f. Pharm. i. 44. Compare Kölliker's experiments upon frogs, VIRCHOW'S Archiv, x. 238.

[2] Chemical Constitution and Physiological Action, Pt. II., p. 712, and p. 719.

[3] La Cigue et son Alcaloide, Paris, 1870.

[4] Practitioner, vii. 58.

It will be observed that the symptoms to which conia gives rise are different from those produced by conium, in being much simpler and much more like what are ascribed to the Greek poison. Whether this depends upon the fact that the Athenian hemlock contained a larger proportion than the Western European of conia, or whether a second poisonous element is united with this principle in the plant, is at present uncertain, but the former supposition seems the more probable.

On Man.—In such doses as are requisite to insure its *alterative* action, conium occasions no sensible phenomena, and hence the best evidence of its action is furnished by the subsidence of the disease for which it is administered. But as, owing to the very uncertain strength of its preparations, it is necessary to increase the dose of conium until some proof of its activity is obtained, it is expedient to know the various phenomena which have been observed. Of these the most important are now to be detailed. One of the earliest signs of its operation is an increase and viscidity of the urinary secretion, and sometimes the perspiration is augmented. The urine is said to be more abundantly secreted, to smart a little when passed, and on standing to deposit a glairy sediment, and to exhale a nauseous smell; no trace of conia, however, can be found in that secretion, nor is its normal composition changed (*Harley*). Such effects are by no means constant, nor is vomiting or diarrhœa, both of which at times occur if a large dose is given at the outset. But in the absence of the more usual symptoms, or after they have subsided, the continued use of the medicine seems to exert a tonic operation; the appetite grows stronger; the bowels, having been constipated, become regular; the skin assumes a more wholesome aspect, and the patient gains flesh and strength. It is during this grade of action, continued for a long time, that several of the characteristic effects of conium are developed, such as the wasting of the mammæ and testicles, and of various glandular tumors, and the loss of venereal desire, effects which the ancients, as has already been mentioned, produced by the external application of the fresh plant, and which the experience of several modern writers has shown to be real.

A somewhat larger dose than suffices to produce the alterative action which has been described, gives rise to more appreciable symptoms. The pulse becomes somewhat slower and fuller, there is a papular or erythematous eruption, with itching of the skin, injection of the eyes, dryness of the throat, acute pains and slight spasms, a sense of fulness in the head, and loss of power in the extremities, some cloudiness of the sight, giddiness, and sometimes copious diaphoresis. One or more of these symptoms may be present, but it is rarely that they all concur in the same case. In fact, they are more apt to be met with together when the drug has been used in rapidly increasing doses, than when the first dose taken is an excessive one. Dr. Pliny Earle has published the results of an interesting series of experiments made upon himself for determin-

ing the physiological action of conium.[1] In the practice of a large insane hospital, Dr. E. never knew conium to produce sleep even when the doses were raised to sixty and ninety grains of the extract three times a day; he therefore rapidly increased the dose which he himself took, from one grain three times a day, until, on the fifteenth day, he took at each dose twenty-five grains. The first of these doses was taken, as usual, before breakfast, and produced such a fulness in the head as might be caused by a ligature around the neck, together with some vertigo. The next day a dose of forty grains induced similar symptoms, and the eyes felt as if swollen. Forty-five grains on the following day caused a repetition of the same sensations, with the addition of weakness and weariness of the knees and a vacillating gait. On the succeeding day a dose of fifty grains was taken. Besides the preceding symptoms, which were renewed, there was a sense of debility in the flexor muscles of the arm, described as "not unpleasant." On the morrow, the whole preceding train of phenomena recurred, and, in addition, there was double vision, and extreme debility of the lower limbs. The pulse was at no time much depressed.

The enormous doses of conium required to produce the effects described in Dr. Earle's experiments render it certain that the preparation used by him was very feeble; and this supposition gains weight when the results obtained by Dr. Fountain are compared with them.[2] Dr. Fountain used an extract prepared from the seeds at a temperature below the boiling point. Of this he took twelve grains, and within an hour set out to ride on horseback. He thus describes the result: "In a few minutes I observed a dimness of vision, with bright points scintillating, or rather quickly moving, in the distance. This caused me to turn from side to side to notice them; and from this cause, I suppose, I found myself reeling in the saddle. There was no vertigo or unpleasant sensation about the head to produce this effect, save a slight feeling of lightness. Very soon a numb pricking sensation was felt in the fingers, extending gradually to the elbows, producing a stiffness of the muscles of the parts, making it difficult to move the forearm and hand. In a few minutes the same sensation was observed in the feet, creeping slowly upward until it reached the upper part of the thigh. The eyes now began to feel uncomfortable, causing me to brush them frequently to clear apparent obstructions from the lids. The pulse was soft and feeble, but not more frequent than usual. In dismounting, about an hour from the commencement of the symptoms, I found so much difficulty in walking as to require assistance to reach the house, the inferior extremities apparently nearly paralyzed. . . . . I tried what effects smoking tobacco would produce. . . . Whether from this cause or from rest and composure, I soon felt very much relieved. Vision became clearer, the limbs less troublesome, and, whilst sitting, little

[1] Am. Journ. of Med. Sci., July, 1845.

[2] Ibid., Jan. 1846.

or no apparent effects of the poison remained. On rising, however, the inferior extremities persisted in their unwillingness to move; but much less so than before. The whole day passed away without my being entirely rid of these feelings, and it was not until I enjoyed my usual sleep that perfect vision was restored. I will observe that the intellect appeared unaffected, the bowels and kidneys were not disturbed, neither was any soporific effect produced."

A very similar train of symptoms is related by Whyte[1] of himself. "In a little more than half an hour after swallowing fifteen or twenty grains of the *extractum cicutæ*, I have only been affected with a weakness and dazzling of my eyes, together with a giddiness and debility of my whole body, especially the muscles of my legs and arms; so that, when I attempted to walk, I was apt to stagger like a person who had drunk too much strong liquor."

John Hunter relates that in a case of phagedenic ulcer resulting from bubo he administered extract of hemlock in doses gradually increased to two ounces and a half a day. "It produced indistinct vision and blindness, loss of voice, falling of the lower jaw, a temporary palsy of the extremities, and once or twice loss of sensation," but nearly cured the disease. Some time after having suspended its use the sore reopened in consequence of some irregularities of diet, and the patient of his own accord took ten drachms of conium in one morning. This produced "great restlessness and anxiety; he dropped insensible from his chair, fell into convulsions, and expired in two hours."[2]

In a still higher grade of its influence, conium often gives rise to essentially the same symptoms that have been detailed, and they may even terminate in death. An illustration of this statement is to be found in the case reported by Dr. Bennet.[3] A poor tailor, named Gorr, ate for dinner some vegetables prepared by his children. Half an hour afterwards he left his house, but staggered in walking. On reaching another house he faltered in his gait, and sat down hastily. He conversed sensibly, drove a hard bargain in selling some trifles, did not complain of pain, and was not at all excited. His face was very pale. He rose from his chair with difficulty, and staggered out of the house and through the street, but was soon obliged to sit down. A policeman who came up thought him drunk, but Gorr told him where he lived, and asked to be taken home, adding that he had lost his sight and the use of his limbs, and indeed he was quite unable to stand. He was conveyed to the police office, and here again correctly gave his address. A physician soon saw him—about two hours and a half after the ingestion of the poison—and found him sensible, but unable to speak, completely paralyzed in all his limbs, and with occasional spasmodic movements of the left leg. His pulse and breathing were natural.

[1] On the Nature, etc., of Nervous Disorders (Edinburgh, 1765), p. 22.
[2] HUNTER's Works (Am. ed.), ii. 234.
[3] Edinb. Med. and Surg. Journ., July, 1845.

About half an hour later the heart was very feeble, the pupils were fixed, and life was soon extinct. On examination of the body, hemlock was found in the stomach; the blood was fluid, and the veins of the head and lungs were congested.

Another case, presenting almost identical phenomena with the foregoing, is thus recorded.[1] A man forty-three years of age, having eaten some conium by mistake, began to stagger, and walked but a short distance. He then fell down, and in a short time his inferior and then his superior extremities became paralyzed. In three hours he ceased to breathe, although his pulse continued to beat. He was quite sensible and conversed until the last moment.

The case related by Haaf, of a soldier at Torrequemada, in Spain, and quoted in all the books, is much to the same purpose.[2]

Dr. John Harley describes the effects upon himself of five and a half drachms of *succus conii*, in terms of which the following is a condensed form: "Three-quarters of an hour afterwards disorder of vision suddenly came on. It was a feeling of giddiness induced by shifting the eyes from one object to another. So long as the eyes were fixed upon an object, the capacity of vision for, and the definition of, the minutest objects were unimpaired, but the instant the eyes were directed to another object, all was haze and confusion, and in order to remove those effects it was necessary to arrest the eyes upon a given object, and there retain them with a fixed gaze. At the end of an hour from taking the dose this derangement of the muscular apparatus of the eye was much increased, and the implication of the third nerve was still further indicated by great dilatation of the pupils, and approaching paralysis of the levator palpebræ muscle. It now required considerable effort to raise the eyelids, and a general muscular lethargy rapidly spread over the body. At the end of an hour and three-quarters I first felt weakness in the legs, especially apparent in the hamstring muscles. At this time I was cold, pale, and tottering, and afraid to retain the sitting posture, lest the muscular lethargy should get the better of me and result in general paralysis. The mind remained perfectly clear and calm, and the brain active. After a little fluttering produced by a sense of alarm, the pulse preserved a natural and regular action, numbering 68. At the expiration of about four hours all effect of the conium had passed off."[3]

In none of the illustrations which have now been presented is any allusion made to delirium or other mental disorder as an effect of poisoning by conium; when, therefore, we read of "constant restlessness and furious delirium" among the symptoms of cases supposed to be those of poisoning by this substance, we may conclude that an erroneous judgment of the cause of poisoning has been formed.

The action of *conia*, the alkaloid principle of conium, has been illustrated by Christison, Geiger, Orfila, Pohlmann, Leonides van

[1] Gazette des Hôpitaux, Nov. 1847. [2] Journ. de Méd., Mars 21, 1812.
[3] Times and Gaz., March, 1867, p. 320.

Praag, and still more completely by Schroff, whose experiments were performed upon three healthy male adults with doses of conia varying from 0.003 to 0.085 grm. ($\frac{1}{20}$ to $1\frac{1}{3}$ gr.), or two drops of recently prepared conia. The taste was very acrid; there was an intense burning in the mouth, with irritation in the fauces, and salivation; in some places the buccal epithelium was abraded, the lingual papillæ projected, and the tongue was benumbed and paralyzed. In three minutes heat of the face and head was felt, with oppression of the latter, giddiness, inability to think or fix the attention on one subject, drowsy hebetude, great impairment of general sensibility, and a sort of discomfort which lasted during the following day. The sight was confused, the pupils dilated, and surrounding objects seemed to swim; the hearing was dull, as if the ears had been stuffed with cotton; the sense of taste was also impaired, and formication affected the entire skin. General debility was marked, the head seemed too heavy, the arms were moved with difficulty, and the gait was staggering at first and unsteady even on the morrow. The muscles of the legs were also readily affected with spasms on any exertion of them, and the same phenomenon was observed in the muscles of the thumbs. Eructation, colic, and flatulent distension of the abdomen, nausea, retching, and in one case even vomiting, were experienced with more or less tendency to diarrhœa. The tips of the fingers and the hands were moist, cold, and bluish, the countenance sunken and pale. Large doses, at first increased and then diminished the frequency of the pulse, but not in proportion to the dose, and it was uniformly small and feeble.[1]

It will be observed that the cases and experiments which have been related present a remarkable uniformity and simplicity of symptoms, viz., vertigo, impaired or double vision, loss of power and slight spasms in the extremities, especially in the lower, and, in fatal cases, death by paralysis of the respiratory muscles; the action of the heart being but little affected, and the mind remaining clear to the last. Kölliker thus sums up the result of his experiments with conia, "it produces paralysis of the nerves of motion, but leaves the brain and nerves of sensation unaffected."[2] These symptoms are precisely such as are recorded of the death of Socrates. When Dr. Bennet, on reporting to the Medico-Chirurgical Society of Edinburgh the case which has been quoted from him, drew attention to this identity of the phenomena in the most ancient and the most recent example, and inferred that the Athenian poison must have been derived from conium maculatum, Dr. Christison observed "that he was inclined to adopt this conclusion; and he felt the more pleasure in stating this, because he had formerly expressed a different opinion."[3] We may now repeat, with Dioscorides, "conium is fatal by its coldness;" that is, by its power of depressing and paralyzing the system.

[1] REIL, Mat. Med. der chem. Pflanzenstoffe, p. 135.
[2] VIRCHOW'S Archiv, x. 238. [3] Month. Journ. of Med. Sci., June, 1845.

It is very difficult, if not quite impossible, after this review, to admit conium to have been the poisonous agent in several cases which have long been referred to as illustrations of its effects. Such is the often quoted instance of the vine-dresser and his wife, who, having eaten some hemlock roots for supper, awoke after the first sleep, and began to run wildly about the house, bruising one another and themselves against the walls;[1] that also of two priests, who, in consequence of eating hemlock, became raving mad, imagined they were geese, and plunged into the water;[2] such are others by Ray[3] and Watson,[4] in which vertigo, raving madness, epileptic fits, convulsions, and coma preceded death; and such, finally, the case related by Bergius of some children who, after eating the hemlock root, were seized with intoxication, vertigo, great heat and pain in the stomach, convulsions, hemorrhage from the ears, trismus, singultus, violent ejaculation of the urine, and retching, and so died.[5] The symptoms in the last case resemble those of poisoning by *cicuta virosa*, and in the previously quoted cases the phenomena have a strong analogy with such as are produced by *œnanthe crocata*, or hemlock dropwort.[6]

If, now, we should attempt to propound a theory of the action of conium upon the animal economy, we should be unable to construct one to embrace and explain all the facts relating to the question. It is very evident that the brain, as the organ of intellection, has no share in the operation; it is equally clear that in different species of animals the effects are different, particularly as regards motor phenomena, for tetanic phenomena which are usual in the lower races are scarcely or not at all perceptible in the highest. That tetanic phenomena occur at all proves the spinal marrow to be affected by the operation of conium, but not that the loss of motor power induced by this drug is necessarily of spinal origin. Another explanation presently to be mentioned is much more probable. In order to illustrate the difficulty of this, and, we may add, of all similar questions, the conclusions of three of the most thorough experimental investigations of the subject may be cited. Dr. Harley[7] holds that conium exerts its power chiefly, if not exclusively, upon the *corpora striata*, and in this manner he accounts for the extreme rapidity with which the paralyzing influence extends over the body. To use his expressions, except the reflex action of the cord, the whole motor function of an individual under the influence of conium is asleep. On the other hand, Martin-Damourette and Pelvet[8] claim to have shown that the muscular paralysis produced by conia is not central in its origin, but results from an action of this substance upon *the extremities of the motor nerves.* Finally Virigo[9] maintains, upon the strength of his experiments, that "the phenomena of paralysis proceed *from the spinal cord* to

[1] MATTHIOLE, Comment., liv. vi. chap. xi.
[2] WIBMER, Wirkung der Arz., ii. 172.
[3] BECK, Med. Jurisprudence, ii, 630.
[4] Ibid.
[5] SIGMOND's Lectures.
[6] Compare TAYLOR on Poisons.
[7] Op. cit., p. 11.
[8] Op. cit., p. 23.
[9] Practitioner, vii. 58.

the peripheric system of motor nerves, which therefore becomes affected after the cord itself." While such discordance of opinion exists respecting the interpretation of experiments performed under determinate conditions, practical physicians may well be pardoned for their want of agreement respecting the operation of medicines under conditions which are neither determinate nor even intelligible.

Remedial Employment. *Cancer.*—Conium had long been used as an external application in the treatment of this disease when Stoerck published his account of its remarkable curative powers as an internal remedy. He also at first employed the plant externally as a fomentation for various tumors and ulcers, and from witnessing its good effects was led to prescribe it internally in the form of an extract. In 1760, this author published fifteen cases described as "scirrhus" or "cancer," of which he affirmed that thirteen were cured and the remaining two improved.[1] There must have been great self-deception or else exaggeration on the part of Stoerck, for such results as he reported have never since been obtained; yet we are none the less indebted to him for the introduction of a remedy into the treatment of cancerous affections which is capable of mitigating the pains of the disease, of suspending its progress, and in some instances, it may be, of removing the suspected deposit entirely. For, although we must admit, with Velpeau, that "at certain stages and in certain forms cancer is as readily diagnosticated as tubercular consumption in its third stage," yet the line of distinction between malignant and non-malignant tumors, at certain earlier stages, and in the living body, is not always demonstrable; there is even reason to believe that the former may become converted into the latter by accidental circumstances. It would seem, therefore, to be a dictate of humanity to embody in the treatment of both classes of tumors an agent which exerts an unquestionable control over the less malignant. Thus we may almost certainly mitigate pain and prolong life, and very possibly even exclude a cause of death. As Oesterlen remarks, we are not so rich in remedies for this class of diseases as to be warranted in forsaking conium. We should remember that the various affections grouped together as cancer are not all equally incurable; that there is not that clear line of distinction between cancerous tumors and such as are the product of simple inflammation which systematic writers describe; and that in recent times, there are well established cases of the spontaneous cure of cancer. I have myself, remarks this author, seen tumors, which I and others had determined to be cancer of the lip, spontaneously get well under the application of simple spring water.[2] That such results are real, a fair estimate of the whole testimony in the case will show.

Fothergill was the first, in the North of Europe, who began to employ conium for the purpose which Stoerck had pointed out, but the results of his experience were very different. "I cannot," he

[1] Translated by JOHN ANDREE, M.D. [2] Op. cit., p. 658.

says, "produce one instance of cancer cured by the *cicuta*, yet I can recollect several in which the pains have been mitigated for a time, the progress checked, and the discharge changed for the better in respect to color, smell, and consistence."[1] To these signs of its utility Rutty adds that it lessens the tumors and disposes the ulcerated portions to heal.[2] Farr, Nicolson,[3] and Douglas,[4] report precisely the same conclusions, and later authorities, such as Vogt, Alibert, Grunther,[5] and Mérat, confirm their correctness in a greater or less degree. Trousseau states that he saw a tumor in the breast of an old lady of seventy-one years of age, and which was pronounced cancerous by Cloquet and Bérard, entirely removed during the application of conium poultices; it is true, the author admits that the iodide of lead and the tincture of iodine were also applied, and that arsenic was given internally.[6] Dr. Walshe thinks it impossible to read the narratives of numerous cases on record without receiving an impression that the disease may be permanently arrested in its advance. But he has found that patients are with difficulty persuaded to persevere in the use of the medicine, and states that the only benefit he has effected by its administration in the uncombined state has been alleviation of pain and irritability, especially in cases of cancer of the stomach.[7] Dr. Harley confirms this judgment, and explains the benefit derived from the medicine by supposing that it allays cramps in the sphincter muscle and thereby prevents pain. Devay asserts that he has resolved engorgements of the mamma having all the characters of atrophic scirrhus by means of this medicine. He commenced by giving the powdered seeds in doses of one-sixth of a grain twice a day, and increasing daily by the same proportion of a grain. This author estimates the dose of conia at one-hundredth of that of conium.[8] Reil, in the same disease, gave one-twelfth of a grain of conia every three hours, and found that it decidedly soothed the pain. In a case of induration of the mamma from injury, it appeared to remove the tumor.

Scrofula. Glandular Enlargements. Eruptive and Ulcerative Diseases.—The much more efficient preparations which are now in general use render it unnecessary to dwell at length on the employment of conium in scrofula. Fothergill, Rutty, and Farr[9] attribute to it anti-scrofulous virtues, but Vogt has pointed out with more precision the conditions under which it is useful.[10] Thus he affirms that while the medicine may be relied upon in scrofula of the skin and external lymphatic glands, and in the cutaneous eruptions and indurations that affect persons of light complexion, delicate skin, and irritable temperament, it is not advantageous in those forms of the disease in which cachexia and an inflammatory tendency of a low grade are combined, producing emaciation, debility, dyspep-

[1] Med. Obs. and Inq., vol. iii., 1767.
[2] Ibid., p. 234.
[3] Ibid., iv. 89 and 348.
[4] Ibid., v. 113.
[5] SOBERNHEIM'S Arzneim.
[6] Mat Méd., 3ème ed.
[7] On the Nature and Treatment of Cancer, p. 195, Lond. 184).
[8] Bull. de Thérap., xlii. 529.
[9] Loc. cit. sup.
[10] Ibid.

sia, etc. Indeed, it is not to be thought of in such cases, except in conjunction with bark and iron. Mere scrofulous suppuration of an acrid or ichorous description, even with some hectic fever, is not in itself a contraindication to its use. A somewhat analogous view is given by Neumann, but he restricts still further the agency of the medicine to scrofula of vascular organs, and praises it especially in strumous ophthalmia.[1] Dr. Baudelocque, Physician to the Children's Hospital in Paris, reports very favorable results in the cure of five out of seven cases of children affected with enlarged and ulcerated glands with fistulous sinuses, abscesses, etc. He prescribed an alcoholic extract of conium in gradually increasing doses until the specific symptoms appeared, which he maintained in a slight degree for a week or more. Once a week each patient was purged. A child with scrofula of the bones derived no advantage from the treatment.[2] Dr. Alexander Fleming claims for conium a marked influence in favoring the absorption and removal of enlarged glands, and in promoting the healing of scrofulous sores,[3] but as he associated with it iodide and bromide of iron, the testimony in regard to conium loses all its value. In the same affections Dr. Harley used it without the slightest improvement in any case.

Under the indefinite title of *obstructions* authors have described a variety of affections as being cured by conium. Some of them were evidently scrofulous, others appear to have been simple hypertrophy, and others enlargement with interstitial fibrinous deposit, especially of the secernent glands. Tumors of the liver, the mesentery, the uterus, the mamma, and the stomach, were among the affections alluded to. In the cases of jaundice which this medicine is reported to have cured,[4] the result must, in all probability, be attributed to its power of promoting the absorption of the adventitious substance which invaded the liver and prevented the escape of the bile from its acini and ducts. Gataker, Wenzel, Recamier, and Dufresnoy, are quoted by Eberle as certifying to its efficacy as a deobstruent. Trousseau assures us that by the long-continued use of conium poultices to the belly he cured two cases of ascites, the one dependent upon chronic peritonitis, and the other on several tumors in the abdomen. The cure was accomplished in three months, and in the last-mentioned case the tumors disappeared entirely. The mammary gland has been known to cease secreting, and to become atrophied under the influence of conium. D'Outrepont relates cases of the sort,[5] and even asserts that the breasts will never again secrete milk. This opinion, indeed, was held anciently, for plasters of conium were directed by Avicenna against the secretion of milk, and, according to Guersent, the drug given internally has produced a like effect.[6] Richter recommends it for the same purpose.

[1] Heilmittellehre, p. 203.
[2] Bull. de Thérap., ix. 126.
[3] Brit. Med. Journ., Apr. 1871, p. 443.
[4] THACHER's Dispensatory.
[5] Am. Journ of Med. Sci., viii. 491.
[6] Dict. de Méd., en 60 vol., art. Cigüe.

The most interesting cases of mammary disease cured by conium are those of Dr. S. W. Williams, of Deerfield, Mass.[1] Some of them are indeed reported as cancerous, but admitting it to be doubtful that they were really so, it is still certain that they afford strong evidence of the curative powers of conium. Where the tumor had not ulcerated, it is described as indurated, knotty, and discolored; where it had advanced to ulceration, there was in one instance induration, abscesses, sinuses, fungi, and a discharge of sanious pus. Another case is described as "real open cancer." "There was an open, ragged ulcer nearly the size of the palm of the hand. It was discharging a thin, ichorous, and highly offensive matter, in large quantities, and occasionally blood. It had somewhat the smell of old brass or copper when exposed to heat and moisture. The edges were jagged and callous, and the whole breast was of scirrhous hardness. It had been open for several months, and there had been an induration in the breast for several years. The constitution was much affected, and the pain in the breast intolerably severe. The stench was so great that the attendants of the patient could not stay with her." In this and the other cases which were perfectly cured, the treatment consisted in the application of a poultice of carrots or of the pond-lily sprinkled with the powdered leaves of conium, and the internal use of the extract of conium, of which the dose was gradually increased until constitutional symptoms were produced. Six cases are reported by Dr. W., of which all got quite well but one, which ended in death.

Other examples of the curative power of conium in "corrosive and malignant" ulcers are to be found, and they deserve to be remembered at the present time, especially when a resort is had to surgical operations with perhaps undue alacrity. Two cases are reported by Rutty, in one of which the sore extended from below the eyelid to the angle of the mouth, and in the other from the ear to the lip and the nose, destroying a part of each; the discharge from both was sanious and fetid. Both were cured by conium in doses gradually increased until its characteristic intoxication was produced.[2] Sir Everard Home, in his tract on tumors, observes, that many which were formerly by violent applications rendered true cancers, now never take on the disease. The treatment he employed was the internal and external use of conium, and he states, in proof of its efficacy, that in some cases where the medicine was left off the symptoms became more violent, and, when it was resumed, abated.

Cutaneous Diseases.—Those which are connected with a constitutional scrofulous taint are said to be most amenable to the influence of conium, and instances are not wanting in which it appears to have been curative.[3] An author quoted by Trousseau and Pidoux, Fantonetti, has published cases which show that baths of

[1] Am. Journ. of Med. Sci., ix. 77.

[2] Med. Obs. and Inq., iii. 237. See also DOUGLAS, ibid. 113; and BAYLE, tom. cit. 622

[3] VALENTIN, Med. Repository, vi. 377; TROUSSEAU and PIDOUX, etc.

the infusion of conium are very efficacious in the treatment both of chronic and acute diseases of the skin. The day before the bath is to be given, this writer directs eight or ten handfuls of conium to be infused in as many pints of water, which, at the proper time, is poured into a bath kept at a temperature of about 90° F. The patient should bathe for an hour or two, and be protected from breathing the vapor by a sheet covering the bath-tub and passed around his neck. The share of the warm water is not to be overlooked in estimating the value of this treatment. In tinea capitis a decoction of hemlock leaves has been used with perfect success.

Diseases of the Nervous System.—A valuable application of conium was introduced a few years ago by the late Dr. Woodward, Superintendent of the Massachusetts Insane Hospital.[1] In some forms of *melancholy*, and especially in chronic diseases of the stomach and digestive organs attended with uneasiness, restlessness, watchfulness, and nervous pains, it often affords great relief, and is an auxiliary in accomplishing a cure. A lady, under the care of Dr. W., was in the deepest melancholy, imagining that she had a hole in her stomach, and that all the food she took was impacted in her abdominal cavity. Her menses were suspended, and she had a uterine tumor as large as a quart bowl. After using for some months extract of conium with carbonate of iron, her delusion vanished, her menses returned, and the tumor gradually diminished, and finally disappeared.

Conium has been regarded by some writers as *anaphrodisiac;* such was the opinion of Aretæus and others among the ancients. St. Jerome states that the Egyptian priests controlled their sexual passions by drinking every day a potion of which hemlock was an ingredient.[2] Bergius, on the other hand, relates a case in which this medicine restored one who was impotent, and Stoerck, after citing a like instance, protests against its being thought liable in any wise to abate the virile powers.[3] Dr. Harley, while denying that it is capable of repressing the natural sexual function, has never known it fail to give relief in cases of exhaustion and irritability from self-abuse, where sexual excitement occurs as an effect of continence, or when an erotic tendency arises from disease of the spinal cord.

In *neuralgic* and *rheumatic* affections, but especially the former, conium was strongly recommended by Fothergill, who cured with it a singularly violent case of *tic douloureux;* also by Chaussier, Dumeril, Rowland, and Dr. James Jackson, of Boston, who states that his experience coincides with that of Dr. Fothergill.[4] Dr. Neligan affirms that in both of these diseases, and in senile gangrene, he has employed it extensively both in hospital and private practice, and has met with very few instances, indeed, in which it failed to afford relief. Dr. N. employed in his practice the *succus*

[1] Annual Report of the Mass. State Lunatic Hospital, 1845.
[2] GUERSENT, Dict. de Méd., v. 212. [3] STOERCK, On Hemlock, 2d Essay.
[4] N. E. Journ. of Med. and Surg., 1813, p. 118.

conii, a preparation made by adding one-fifth part by measure of alcohol to the clear and supernatant portion of the expressed juice, and which he declares to retain its virtues much longer than an extract prepared by evaporating the fluid part of the same compound. Thirty minims, three times a day, are stated by him as the average dose of this preparation.[1] Reil mentions conia as a very successful application in *toothache*, when the nerve is exposed. Conium has been found by many authors useful in *photophobia*, especially in that distressing form of it which exists in scrofulous ophthalmia; Dzondi, Kopp, and Otto have reported numerous cases of the sort.[2] In *whooping-cough*, conium has been, like all the other reputed narcotics, employed with a certain degree of success, by Butter, Odier, Roe, Spengler, and others; but the evidence of its usefulness is not such as to entitle it to much confidence.[3]

The singular relaxation of the muscular system produced by conium has naturally led to its employment in *convulsive diseases*, particularly by Dr. Harley, who has published some very striking illustrations of its efficacy in *laryngismus stridulus* and other forms of *local spasm*. In regard to *epilepsy*, Dr. H. regards conium as the appropriate remedy for cases in which the attacks are due to morbid excitement of the motor centres, but it may be suspected that his judgment was warped by a belief that conium acts primarily upon the motor centres of the brain; for he refers with especial commendation to its utility where the disease arose from sexual abuse, or the irritation of dentition, cases in which the cause was clearly not centric, and notes its failure in emotional cases, which were just as certainly centric in their origin. In imitation of Harley, Dr. Echeverria has used conium in epilepsy, and found it preferable to belladonna. The latter he regards as most useful in epilepsia minor, or when it is associated with the convulsive form; but of conium he states that "it is of great assistance chiefly in epilepsy attended by cerebral derangement or vertigo."[4]

In *chorea* Dr. Harley furnishes reasons, drawn from an assumed view of the nature of the disease, why conium should be useful in its treatment. Unquestionably, the suggestion of its use in this, and in all other spasmodic affections, naturally grew out of its remarkable power of paralyzing the muscles; the explanation was only an after-thought. The clinical results of the use of the medicine in five cases of chorea reported by Dr. Harley are extremely favorable to a belief in its control over even the most obstinate forms of this affection. Some years ago (Jan. 1869), in the Philadelphia Hospital, a young man was under our care for this disease, which apparently originated in sexual exhaustion. The spasms were so violent and incessant that it became necessary to confine the patient in a box-shaped bed. Conium-juice was administered in rapidly increasing doses until its physiological effects became

[1] Dublin Journ. of Med. Sci., Nov. 1844, and Nov. 1845.
[2] SOBERNHEIM, loc. cit. [3] GIBB, On Whooping-cough, p. 289.
[4] On Epilepsy, New York, 1870, p. 307; Philad. Med. Times, April, 1871, p. 252.

apparent, and as far as possible they were maintained at that point, the spasms steadily declining meanwhile, and at last ceasing altogether at the end of about four weeks. A similar case occurring in a syphilitic patient was cured by the same method employed by Mr. Mitchinson.[1]

Conia has been used internally for the diseases to which conium is applicable; and cases are reported by German practitioners of its successful employment, both internally and externally, in painful and convulsive affections and glandular disorders. The doses varied from one-twentieth to one-sixteenth of a grain; or from one-twentieth to one-fifteenth of a grain was dissolved in six ounces of distilled water, and three tablespoonfuls of the solution given daily.[2] As contraindications for the use of conium, and especially of its active principle, may be stated a tendency to paralysis, organic diseases of the heart, and great debility resulting from chronic disease.

Antidotes.—In several of the most authoritative works, emetics are recommended for poisoning by conium and its preparations, and cases are reported in which tartar emetic was administered according to these general directions, and the patients died.[3] If it is judged proper to evacuate the stomach, a stimulant emetic, such as mustard, is to be preferred to one whose tendency, like that of the poison, is to produce fatal sedation. Warm oil, with a small portion of ipecacuanha, may also be employed. Bloodletting, which is also recommended, probably has no experience in its favor. The ancients regarded wine as the proper counter-poison of conium. Mercurialis says: "Sicut cicuta homini, sic cicutæ vinum." Dioscorides advises the same remedy after the evacuation of the stomach by emetics, and of the bowels by clysters, and further directs milk or whey to be administered along with aromatic stimulants. Matthiolus adds to these precepts that the patient should be kept warm, and in motion as much as possible. Indeed all the ancient authorities agree in the opinion that stimulants are the essential remedies for poisoning by hemlock, and the same treatment has been revived by physicians of the Italian school, who direct wine, brandy, and other agents of the class of diffusible stimuli.[4]

Administration and Dose.—Conium may be given in substance; the expressed juice, the extract, and the tincture are preferable forms. The dried leaves are, in general, quite inert, and ought not to be depended upon unless very recently gathered. The dose is from one grain upwards. Of the extracts from one to two grains may be prescribed for the first dose; of the fluid extract about five minims; and of the tincture, which is an ineligible form on account of the quantity of alcohol that must be taken as the doses are augmented, half a fluidrachm. Of the juice (succus conii)

[1] Times and Gaz., Feb. 1869, p. 197.
[2] OESTERLEN, loc. cit.
[3] Journ. de Méd., xxiii. 107. In the case here referred to, twelve grains of tartar emetic were administered!
[4] Annales de Thérapeutique, iv. 75.

the commencing dose is about one fluidrachm. Whatever form is preferred, the dose of the medicine should be gradually but rapidly increased until unequivocal symptoms of its operation are manifested; then, and not before, should the daily increase of the dose be suspended or diminished.[1] In no other manner is it possible to have assurance that the preparation employed is really active. Conia, on account of its tendency to decomposition, is recommended to be mixed with twice its volume of muriatic acid, and excluded from the light. Its maximum dose is stated to be one grain (*Van Praag*), but the average dose is generally said to be from $\frac{1}{100}$ to $\frac{1}{25}$ of a grain.

The conium plaster is used upon indurated, swollen, or painful parts, but its efficacy, beyond what is due to the general excitation it maintains on the spot where it is applied, may well be questioned. It is made by melting together yellow wax ℔j; rosin and sweet oil, of each ℔ss; and to this, when half cold, is added powdered hemlock ℔j.[2] It is not officinal, and should not be confounded with the plaster of hemlock (*Pix Canadensis*).

Conium cataplasms, made with the fresh plant bruised, or, in default of this, with the extract or ointment laid upon the surface of emollient poultices, are not to be neglected in those forms of external disease in which this medicine has been recommended for internal use, and especially in malignant and foul ulcers. Conium baths may be directed in cases of rheumatic and cutaneous disease.

GELSEMIUM.—YELLOW JASMINE.

Description.—Gelsemium is the root of *Gelsemium sempervirens*, yellow or Carolina jasmine, a native of the Southern States, where it grows in swamps and in alluvial regions. It is a climbing plant, "ascending lofty trees, and forming festoons from one tree to another, and in its flowering season, in the early spring, scenting the atmosphere with its delicious odor." Its flowers are in axillary clusters, and of a deep-yellow color. They are said to be poisonous. The root as it occurs in commerce is in short and split pieces, very light and fibrous, of a dull yellowish-white color, with a faint narcotic odor, and a bitterish and not unpleasant taste. It yields its virtues to water, but more fully to diluted alcohol. They are supposed to depend upon a peculiar alkaloid, *gelsemia*, which exists in the root in combination with gelseminic acid. Dr. Wormley describes gelsemia as "a colorless, odorless solid, having an intensely bitter taste."

EXTRACTUM GELSEMII FLUIDUM.—*Fluid Extract of Yellow Jasmine.* It is prepared from sixteen ounces of the finely powdered root so as to produce a pint of the preparation.

[1] Dr. Garrod states that he found it necessary to administer the best London tincture in doses of from half a fluidrachm to a fluidounce in order to obtain any appreciable physiological effects. (Times and Gaz., Feb. 1864, p. 168.)

[2] SOBERNHEIM, op. cit.

Action. *On Animals.*—Injected under the skin of a frog, by Dr. Bartholow,[1] it produced in a few minutes a loss of muscular power, with apparent loss of sensation. The heart continued to beat until the animal's death. From another experiment upon a frog, Dr. B. inferred "that gelsemium destroys the excitability of the sensory nerves before the motor, that it does not impair muscular irritability, and that its action as a paralyzer is upon the centre, and not upon the peripheral nerve fibres." Applied in the same manner to a pigeon, the legs and then the wings of the animal became paralyzed, and the eyelids partly closed. Consciousness was unimpaired, but sensibility was completely abolished. Death occurred in a convulsive tremor, during which the eyes were closed, the feet extended backward, and the wings widely expanded. The action of the heart continued after respiration had ceased. A kitten displayed essentially the same phenomena.

On Man.—Dr. J. T. Main, after taking by mistake a drachm of the fluid extract of gelsemium, became nearly blind, was unable to raise his eyelids, the flexor muscles of the hands and arms were paralyzed, and the extensors nearly so; sensation in the hands and arms was blunted and the speech somewhat affected, but the mind was quite clear.[2] A current from a galvanic battery soon brought relief. In another case a much larger dose had been taken. The patient, a married woman, was totally unconscious, the breathing imperfect and stertorous, the face livid and pale, the lower jaw and the eyelids drooping, the pupils moderately dilated, the pulse 100, regular, but weak. Recovery was not complete for several days, during which there was great prostration, with feebleness of the elevator muscles of the lower jaw, eyelids, and muscles of the arms. At first speech was only possible while the lower jaw was supported; the tongue was thick and the voice guttural. The patient stated that before she became unconscious, objects appeared double, and that she grew by degrees completely blind. There did not seem to be any direct sedative action of the poison upon the heart.[3] In the following cases the poison was fatal: A gentleman took by mistake a tablespoonful of fluid extract of gelsemium. When seen, his face was congested, pupils dilated, eyelids and lower jaw drooping, the tongue "thick," the respirations slow. Consciousness was not impaired until an hour before death, which occurred two hours and a half after the poison had been taken.[4] A young healthy married woman, several weeks pregnant, took three teaspoonfuls of the fluid extract of gelsemium. Within two hours she complained of pain in the stomach, nausea, and dimness of vision, which were followed by great restlessness, ineffectual efforts to vomit, and free perspiration. In five hours the pulse was feeble, irregular, and intermittent, there was great prostration, with irregular and slow respiration. The skin was

[1] Practitioner, v. 203.
[2] Boston Med. and Surg. Journ., April, 1869, p. 185.
[3] PINKHAM, Ibid., Feb. 1871, p. 89.
[4] Am. Journ. of Med. Sci., Jan. 1867, p. 271.

then dry; the extremities cold; the pupils dilated and insensible; the eyes were fixed and the eyelids could not be raised. No convulsion occurred, but death took place in about seven hours and a half after the poison had been taken. On examination of the body, its dependent parts appeared "congested." The lungs were slightly collapsed, and the heart distended with dark grumous blood, in which were also yellow fibrinous clots.[1] The phenomena presented by these cases strongly resemble those produced by conium. According to Dr. Bartholow the analogies and contrasts of the two poisons may be summarized as follows: "Conium is a paralyzer, but, unlike gelsemium, the paralysis commences at the periphery, and rapidly extends to the motor centre. Conium, like gelsemium, does not destroy the muscular irritability. Gelsemium impairs the sensibility of the sensory nerves, which conium does not. Both cause death by asphyxia—paralysis of the muscles of respiration. In their effects on the brain they act similarly, neither of them destroying consciousness until carbonic acid narcosis supervenes. Both produce dilatation of the pupil and blindness; but gelsemium more distinctly paralyzes the third pair than conium."

Uses.—The discovery of the supposed medicinal virtues of this drug was, as in the case of all others, accidental. A tea made from the root was administered by mistake to a man in bilious fever. Its poisonous effects were developed, but they passed off, and with them the fever. The patient employed the same medicine for his friends in like condition, and they recovered. It then was taken up by the practitioners called "eclectics," and through them came into general use. It was employed in intermittent, remittent, typhoid, and yellow fevers, the irritative fevers of childhood, inflammation of the lungs and pleura, dysentery, rheumatism, neuralgia, dysmenorrhœa, morbid wakefulness, nervous coughs, delirium tremens, trismus nascentium, chorea, epilepsy, gonorrhœa, aortic regurgitant disease of the heart, irritable bladder, etc. This enumeration of incongruous diseases alleged to have been cured by gelsemium is sufficient to show that its proper place in therapeutics has not been yet determined. So far as we have been able to examine the reports upon which the above statements rest, we find them vitiated by the usual errors, such as neglect or ignorance of the natural course of diseases, and a disposition to attribute results to a particular one out of several equally active medicines administered at the same time. For example, one physician reports several cases of "irritable bladder" as cured or relieved by this medicine, leaving almost entirely out of the account the carbonate of potassa and bromide of potassium which were associated with it, and which are usually employed as the proper palliatives of the condition described. It is to be desired that an agent which exerts such peculiar sedative powers upon the nervous system should be tried by clinical experts and scientific interpreters.

Administration.—The only preparation of uniform strength

[1] Wormley, Am. Journ. of Med. Sci., April, 1870, p. 581.

made from gelsemium is the officinal fluid extract. Its dose is not accurately determined, but may be stated at about ten minims every two or three hours, until the characteristic effects begin to appear.

COCCULUS.—Cocculus Indicus.

Description.—This agent, which is not officinal, is the fruit or seeds of *Cocculus suberosus*, or, as it is called by others, *Menispermum Cocculus*, and *Anamirta Cocculus*, a native of Southern Malabar and Amboyna. It is a large, climbing plant, with a very thick stem, covered with a wrinkled, corky bark; the leaves are cordate, the flowers, which are in lateral compound racemes, have an unpleasant smell. The fruit is a one-celled berry, of a dark purplish color, with a soft pulp, and a single seed or nut. When dried, the berry is about the size of a pea, of a dark grayish color, wrinkled and inodorous. The seed is of a semilunar form, oleaginous, and very bitter. It was known to the Arabian physicians. The active properties of the plant are derived from an alkaloid principle, *cocculin* or *picrotoxin* (bitter poison), which is described as white, transparent, crystallizable, inodorous, and of a bitter and burning taste; it is partially soluble in cold, but more readily in hot water, and wholly in acidulated water, alcohol, and alkaline solutions, but less so in ether. This principle was discovered by Boullay in 1812, and more recently by Couerbe, in the kernel of the fruit.

Action. *On Animals.*—Cocculus has been used by the orientals from ancient times for the purpose of catching fish. When half ripe, the bruised berries are formed into little pellets, which are cast upon the water, and are eagerly devoured by the fish. The animals are soon seized with dizziness, and after whirling round, remain motionless and float upon the surface of the water, where they are readily captured. According to Goupil the flesh of these fish acts as an irritant to the stomach of animals that eat it, and especially that of the barbel, which resists its operation longer than others, and probably, therefore, becomes more thoroughly impregnated with its active properties. It is notorious, however, that fish taken by means of cocculus are eaten without harm, and Neumann says that, in the course of his long life, he never met with an instance of mischief from its employment.

Boullay found that one grain of picrotoxin was enough to kill a large frog. Orfila gave from twelve to sixteen grains of finely-powdered cocculus to dogs, and immediately tied the œsophagus. The animals soon made repeated attempts to vomit. After twenty or thirty minutes their attitude and movements were unsteady; their eyes wild and staring; a trembling of the muscles, slight at first, but gradually increasing, seized them; presently the muscles of the face were thrown into violent convulsive action; they then of a sudden took several steps backwards, and stretched their fore paws stiffly out, but barely avoided falling; the head was thrown

backwards with a sudden and violent motion, strong enough at times to make the animals fall upon the back, and then roll in every direction. If these phenomena were suspended for a minute or two, they got up and attempted to walk forward, but were attacked anew; the paroxysms grew more frequent and violent, the animals lying on the side and moving their paws backwards and forwards with astonishing rapidity. The head and tail were more or less bent upon the spine. The animals seemed to have lost all sensibility; they could be moved, struck, or cried at without betraying the least consciousness. There was foam upon the lips, the tongue and gums were livid, the conjunctiva injected, the breathing hurried and labored, and sometimes there was a discharge of urine and fæces. This state was of two or three minutes' duration, and was succeeded by alternate paroxysms and quietness until death took place, which was generally about half an hour after the poison was administered. Nothing peculiar was discovered on examining the bodies of the animals. From the experiments performed by him, M. Orfila concludes: 1. That powdered cocculus is poisonous to dogs. 2. That, like camphor, it acts upon the nervous system, and principally on the brain. 3. That its active principle is picrotoxin. 4. That vomiting is the best antidote to its effects.[1]

Dr. Glover[2] administered to an ass one hundred and twenty grains of picrotoxin, and an hour afterwards one hundred grains more. The dose had hardly been administered for a few minutes, when the animal salivated profusely; she then began to strike the ground with her fore feet. The breathing became laborious; she suddenly ran backwards for at least twenty paces, fell on her side, and expired after a terrible fit of tetanus which lasted for about five minutes.

A pigeon had ten grains of picrotoxin put under the skin of the axilla. In fourteen minutes, convulsive backward movements of the head and neck were observed. At the sixteenth minute, the animal vomited from its crop; strange motions of its feathers, very difficult to describe, occurred; it seemed as if they were agitated in all directions. The animal fell on its side, in which position, by movements of one wing, it contrived to turn itself round in a circle, as if rotating on a pivot. This lasted for several minutes. It exhibited, also, spasms of opisthotonos, and picked at the ground with its bill.

A small goldfish was put into a dish of water with five grains of picrotoxin. In half an hour the fish seemed excited; it sprang twice out of the glass; it then gradually lost the power of keeping the belly vertical, and inclined sideways. In about forty-seven minutes it could be taken out of the water without struggling; it gradually lost the power of motion, and in about six hours was dead. In several of Dr. Glover's experiments, the animal temperature was greatly elevated.

[1] Toxicologie, 5ème éd., ii. 648.
[2] Month. Journ. of Med. Sci., April, 1851.

The experiments of Drs. Bonnefin and Brown-Séquard led them to several conclusions, of which the most interesting is, that "picrotoxin does not appear to excite convulsions directly or by stimulation, but indirectly, or by increasing the reflex power of the cerebro-spinal axis." Thus, for example, if the brain and medulla oblongata be removed from a frog, annihilating its power of voluntary motion, it remains quiet under the influence of picrotoxin so long as it is undisturbed, but, if stimulated, is seized with irregular convulsive movements, and tetanic rigidity. The same phenomena were produced in a guinea pig.[1] Such effects are closely analogous to those of veratria.

The experiments of Tschudi present the following comparative results of the administration of strychnia and picrotoxin; both substances being given in two grain doses:—

STRYCHNIA.	PICROTOXIN.
Causes tonic spasms.	Tonic and clonic spasms alternating.
Kills in three minutes.	Kills more slowly, *e. g.*, an hour and a half.
Does not act upon the brain.	Acts in some degree as a narcotic on the brain.
Never causes vomiting.	Excites frequent vomiting.
Does not act upon the secretion of saliva or bile.	Increases both in a very remarkable manner.[2]

The subsequent experiments of Falck on various animals do not differ materially in their results from those given above, and they all tend to prove that cocculus and picrotoxin expend their action chiefly upon those portions of the nervous system which control muscular movements.[3]

On Man.—The action of cocculus Indicus in moderate doses does not appear to be well ascertained. But the chief symptoms are slight giddiness, a feeling of lightness in the head, and a partial loss of power in the lower limbs, which seem to require unwonted exertions to move them. In larger doses it may produce death, for at least two cases of this effect are on record. A sickly, cachectic looking boy, twelve years of age, ate about two scruples of cocculus with cheese. A few minutes afterwards, he complained of a disagreeable taste in the mouth, with burning in the throat and stomach, and vomited several times without relief. Three days afterwards, he presented the following symptoms: Fulness and heaviness of the head, dizziness, anxiety, and restlessness; forehead hot, and covered with a slimy sweat; the eyes turned outwards, etc. The remaining symptoms were those of gastritis; and, on the nineteenth day from the ingestion of the poison, the patient died. On inspection of the body, the vessels of the pia mater were found filled with dark-colored liquid blood. There was serous effusion in the ventricles of the brain, and the right lung was congested. In the abdomen, there were all the marks of peritonitis in an advanced stage.[4]

[1] Thèse pour le Doctorat en Médecine. Par F. W. BONNEFIN, 1851.
[2] CANSTATT'S Jahresbericht, 1848, p. 137. [3] Ibid., 1853, p. 157.
[4] Frank. Mag. für Arzneimittellehre, i. 717.

Uses.—Cocculus Indicus is very generally employed, according to oriental example, for destroying *lice* and other human parasites, and for this purpose is used in decoction or in an ointment. The latter should be prepared from the kernels alone. It is also a very successful remedy in *ringworm of the scalp*. Dr. Christison recommends it for this purpose, and directs the ointment to be applied twice a day after washing the skin well with soap and water. The same author found an ointment of picrotoxin made with ten grains of the alkaloid to an ounce of lard of service in bad cases of porrigo. A tincture of the fruit applied to the scalp for the cure of tinea has occasioned death preceded by spasms.

Dr. Taylor states "it is employed by unprincipled brewers for adulterating porter, being unblushingly recommended by Childe and by Morris in their books 'on brewing.'" It is said to prevent the secondary fermentation of malt liquors.

The resemblance between the action of picrotoxin and strychnia led Tschudi to suggest the use of the former in *paralysis* of the extremities and of the sphincters; and Reil, acting on this suggestion, employed a tincture of the seeds with success in *chorea*, hemiplegia from cold, and paralysis of the bladder from the same cause.[1]

DULCAMARA. Vid. *Narcotics.*

LOBELIA.—LOBELIA.

Description.—*Lobelia inflata*, from the leaves and tops of which this medicine is derived, is an annual or biennial plant, which is common throughout the United States, and grows in neglected fields, along road-sides, and at the edges of woods. It has an erect, angular, and hairy stem, one or two feet high; ovate, serrate, and hairy leaves; and numerous pale-blue flowers in terminal racemes, which are succeeded by ovoid, inflated, and striated capsules, containing in two cells numerous small brown seeds. The whole plant is endowed with active properties, but the leaves and capsules are to be preferred. It has a somewhat irritating odor, and, "when chewed, though at first without much taste, soon produces a burning, acrid impression upon the posterior parts of the tongue and palate, very closely resembling that occasioned by tobacco, and attended in like manner with a flow of saliva and a nauseating effect upon the stomach."[2] It yields its properties to water and alcohol; but heat in a great measure destroys them. It contains an active principle which was discovered by Dr. S. Colhoun, but first isolated by Prof. Procter, of Philadelphia, in 1834, and by him called *lobelina*. Subsequently, in 1843, Reinsch gave the name of lobelina to a compound body which he regarded as containing the active principle of the plant, and in 1850 Mr. Bas-

[1] Mat. Med. der rein. Pflanzenstoffe, p. 229.

[2] U. S. Dispensatory.

tick more perfectly isolated it by employing the process recommended by Liebig for procuring hyoscyamia.

Lobelina is a clear, volatile liquid, of a whitish or light yellow color, which emits but slightly the characteristic odor of lobelia, except upon the addition of ammonia. It is soluble in water, but more so in alcohol and ether. Its reaction is alkaline, and it unites with acids to form salts which are very soluble.

Tinctura Lobeliæ.—*Tincture of Lobelia.*

Two pints of tincture are obtained by displacement from four troyounces of finely-powdered lobelia.

Action on Animals and on Man.—The effects produced by lobelia and its alkaloid are almost identical with those of tobacco and nicotia, but larger doses are required to produce them. Mr. Procter administered a grain of *lobelina* in solution to a cat. In less than two minutes it occasioned violent emesis and much prostration, from which the animal fully recovered in three hours. Again, one grain of the substance in an ounce of water was introduced into the stomach of a cat by means of a tube. Immediate and total prostration was the consequence, which in half an hour rendered the animal almost motionless; its pupils were much dilated. It gradually recovered its strength, but the effects of the poison were evident for fifteen hours afterwards. No emetic or cathartic operation was produced.[1] Thacher asserts that horses, although very fond of the plant, have been fatally poisoned by it.

Dr. Baraillier observed the following phenomena in himself after taking forty drops of tincture of lobelia. Nausea and an almost irrepressible disposition to vomit; eructations; general and very depressing debility; præcordial distress; extreme difficulty in breathing as if the chest were confined by a cord; dysphagia; hoarseness; vertigo, headache, disturbed vision, dilated pupils, constant nausea; walking became difficult, and the pulse was small, irregular, and 50 in a minute. This condition lasted for an hour, and was followed by a dull somnolence which the least noise interrupted, by slight colicky pains, aversion to food, and finally, at night, by unrefreshing sleep.[2] According to Noack,[3] the symptoms of poisoning produced by lobelia in the human subject are, pain in the back of the head, increased secretion of saliva and mucus, dryness, burning, and rawness in the throat, malaise, nausea, vomiting, irritation in the œsophagus and oppression at the præcordium, eructation, flatulent discharges from the bowels, and an increased flow of urine; to which may be added great general relaxation, and, when the doses are excessive, extreme prostration, anxiety, and distress, contracted pupils, insensibility, and occasionally death, preceded by convulsions. A large number of cases have been published of death from the maladministration of this drug by ignorant persons assuming to be practitioners of medicine. Some of

[1] Pereira, Am. ed. [2] Bull. de Thér., lxvi. 72.
[3] Die Neuen Arzneimittel. Stuttgart, 1842.

these have taken place in the United States, but the greater number in Great Britain. In 1853, Dr. Letheby testified "that thirteen cases of poisoning by lobelia had occurred within the last three or four years, and that in six of these the coroner's jury had brought in a verdict of manslaughter."[1] On trial, however, the culprits generally managed to escape, until, in 1856, one was convicted and sentenced to three months' imprisonment.[2]

Remedial Employment.—The first mention made of the medicinal properties of lobelia was by Shoepf, who travelled in this country about the middle of the last century, and who merely states that it possesses astringent qualities, and is used in ophthalmia. This statement is clearly erroneous. Van Swieten furnishes a much juster appreciation of its virtues when he speaks of his having learned it to be a certain and safe remedy for the *venereal disease*, and that a decoction of the root of lobelia, drunk upon an empty stomach, in a large dose, occasions vomiting, in a less dose purges, and in a smaller still brings on a sweat.[3] For its later introduction to the notice of the profession we are indebted to the Rev. Dr. Cutler, of Massachusetts, who used it successfully in his own case for attacks of *asthma* to which he was subject. He acquired a knowledge of it from Dr. Drury, of Marblehead, who was also subject to asthmatic paroxysms, and whom it permanently cured. Dr. C. had a saturated tincture of the plant prepared, of which he took a tablespoonful in one of the worst paroxysms he ever experienced, and after it had continued a considerable time. "In three or four minutes," he declares, "my breathing was as free as it ever was. In ten minutes I took another spoonful, which occasioned sickness. After ten minutes I took a third, which produced sensible effects on the stomach, and a very little moderate puking, and a kind of prickly sensation throughout the whole system, even to the extremities of the fingers and toes. Since that time I have enjoyed as good health as perhaps before the first attack." It is in this disease that the virtues of lobelia appear to have been chiefly tested by physicians, although, as is well known, they have been made the subject of extravagant eulogy by a notorious charlatan and his sectaries, held up as a panacea, and employed with blind rashness in almost all complaints. A professor in a French naval school of medicine states that lobelia is employed by North American physicians in the treatment of asthma, but that they rarely employ it alone, preferring to associate it with strychnia, and sometimes with iodide of potassium![4] This statement, for which no authority is given, has not any foundation in fact.

Dr. Bigelow, in the account which he furnishes of lobelia,[5] quotes Dr. Randall as stating that it is as successful in asthma as any article that he had tried; that it removes the paroxysm in a short

[1] Times and Gaz., May, 1854, p. 491.
[2] TAYLOR, Med. Jur., 2d Am. ed., p. 732.
[3] Comment. on Boerhaave, xvii. 337.
[4] Bull. de Thérap., lxvi. 103.
[5] Med. Botany.

time, and restores the patient to quietude and ease. Although the prejudice against the medicine inspired by the mischief it was inflicting in the hands of rude and ignorant practitioners has limited the sphere of its usefulness, there can be no doubt that it deserves more confidence than it has yet received. In support of this opinion the statements of European practitioners may be interesting to the reader. One of the first to employ lobelia in England was Dr. Elliotson, who states that it is by far the best medicine in spasmodic breathing he was acquainted with, and that although the cause of the attack be not removable, it will still do good. Even in asthma produced by, or at least complicated with, aneurism which ultimately bursts into the trachea, he found the greatest advantage from this medicine.[1] "With many," says Dr. E., "it acts as a charm, and in ten or twenty minutes they will be perfectly relieved, so that all the other remedies used in asthma are as nothing when compared with it." But this author very properly distinguishes the cases in which it is appropriate, and would restrict its use almost entirely to those in which the nervous element is the predominant one. A very similar opinion is set forth by Mr. Bower,[2] who professes to have had much experience in its use. In all cases, he remarks, where dyspnœa is a leading and urgent symptom, lobelia is applicable. I say in *all* cases, because I have never observed any unpleasant effects from its administration, though many are the cases, of opposite characters, which give rise to this distressing symptom. Neumann[3] announces lobelia as one of the most valuable medicines in diseases of the *lungs*. According to him, it relaxes the spasm of the respiratory muscles with incredible rapidity, and even in cases depending upon organic causes—disease of the heart, for example—it often affords speedy relief. In organic diseases of the lung itself, when a tormenting dry cough and an insufferable tickling in the throat rob the patient of rest, it is in the highest degree beneficial. Nothing approaches the direct and specific action of lobelia upon the motor nerves of respiration. It is speedier and more certain in its operation than digitalis, and more direct than ipecacuanha. The language of Schlesier[4] is even more laudatory. He thinks lobelia cannot be sufficiently commended in spasmodic asthma; when the patient is panting with sudden and extreme oppression, when he strives to cough but cannot, and feels every instant ready to suffocate, it dissipates these terrible symptoms like magic. Like Neumann, Schlesier employed it even when the asthma was connected with disease of the heart, and found not only that it relieved the existing paroxysm, but that it made the intervals between the attacks longer. He also prescribed lobelia in two cases of *chronic bronchitis* with copious purulent expectoration, and considered it a reliable palliative. On the whole, Schlesier pronounces it a true anti-asthmatic, a most valuable sedative of tormenting, dry, and irritative spasmodic cough, and a genuine alterative of the vitality

[1] Lancet, Oct. 27, 1832, and Jan. 26, 1833.
[2] Ibid., Nov. 23, 1838.
[3] Heilmittellehre; and DIERBACH, ii. 234.
[4] DIERBACH, ii. 235.

of the bronchial mucous membrane. Behrend, of Berlin, employed the ethereal tincture of lobelia in a case of pure nervous asthma, and in one depending upon organic disease, and obtained from it relief in both. Andrews, Morelli, and others, testify to its usefulness not only in *asthma* but in *whooping-cough*, spasmodic croup, etc., and in all the pulmonary affections in which it is desirable to promote the natural secretion of the bronchia.[1] Tott relates the case of a shoemaker who for many years suffered from humid asthma, and for whom assafœtida, belladonna, blisters, etc., had been tried in vain. For two years after taking lobelia he remained perfectly well. Another case, the subject of which was a sailor, presented the same conditions, and was in like manner speedily and permanently relieved.[2] Eberle states that he had several very striking examples of the good effects of this article in asthma. "Its operation," he remarks, "is often surprisingly prompt and effectual. I have known the most frightful paroxysm completely allayed in less than fifteen minutes. Even where the disease depended on organic affection of the heart, it has generally speedily mitigated the distressing difficulty of respiration." The same writer used lobelia in *whooping-cough* with unequivocal advantage. For the latter purpose he recommends that it be united with syrup of squills, or with belladonna. These examples might be still further extended, and might be corroborated by some drawn from the personal experience of the author; but they are perhaps sufficient to show the high degree of utility of lobelia in asthmatic affections, whether dependent wholly, or in part only, upon nervous derangement. There can be little doubt that it fulfils indications in asthmatic attacks which no other medicine is so well able to meet, and that its properties deserve to be carefully tested by physicians, in order that humanity may not suffer by leaving an instrument apparently of such energy and value in the hands of unskilful and ignorant men.

As an *emetic* lobelia has been recommended by Bidault de Villiers, and others, especially in *croup*. Dr. Bigelow is of opinion that in this application the medicine has no especial claim to confidence, but Eberle employed it in several cases with very great benefit. As these opinions were put forth at a time when spasmodic laryngitis was not well distinguished from the pseudo-membranous form of the same disease, the dissidence may be readily explained. In the former disease an agent is required merely to relax the laryngeal spasm, and this indication is completely fulfilled by lobelia; but in the plastic and inflammatory affection, a sedative is needed to abate the inflammatory action, but also, and above all, an emetic capable, by provoking violent efforts at vomiting, of expelling the fibrin which obstructs the larynx. In *spasmodic* or *stridulous laryngitis*, therefore, lobelia perfectly fulfils the conditions of cure.

Administration.—Lobelia may be given in *substance*, *infusion*, or *tincture*. Of the powdered leaves, the dose of an emetic is from ten

[1] DIERBACH, i. 160. [2] Bull. de Thérap., xxx. 382.

to twenty grains, and as an expectorant, from one to five grains. But a more eligible form is an infusion, which may be made according to the following formula: ℞.—Lobelia, gr. lx to gr. xc; add enough boiling water to make when strained f℥iij to iv; syrup, f℥j. *Dose*.—A tablespoonful every two hours, in catarrhal affections of adults.

The preparations most frequently employed are the tinctures: *Tinctura Lobeliæ* (U. S.) and the *Tinctura Lobeliæ Ætherea* (Br.), of which the dose, as an expectorant, is ♏x to f℈j. In asthmatic attacks one or two fluidrachms may be administered every hour.

TABACUM.—Tobacco.

Description.—Tobacco consists of the commercial dried leaves of *Nicotiana Tabacum*, an annual plant of the Nat. Ord. *Solanaceæ*, which is indigenous to America, but cultivated in all parts of the world. It has a round viscid stem five or six feet in height, which, like all other portions of the plant, is covered with a short down. The leaves are very large and long, and of a pale green color; the flowers are monopetalous, of a pale greenish color, expanding above into rose-colored segments. The calyx, like the leaves, is somewhat clammy and pubescent.

Tobacco, when simply dried, is destitute of the peculiar narcotic and pungent odor which belongs to the prepared leaves. This quality is developed by moistening the leaves with salt water, and heaping them together until fermentation has taken place. During this process the nitrogenous element of the plant is decomposed and forms ammonia, which appropriates a portion of the acid in the tobacco, and liberates a certain amount of nicotia, and this, along with the ammonia, develops the characteristic odor of prepared tobacco. As a consequence, it contains much less nicotia than the leaves in their natural state. Indeed, according to Boutron and Henry, the proportion of this alkaloid in the latter is two or three times greater.[1]

Nicotia was first obtained in an impure condition, by Vauquelin, Robiquet, and Warden, in 1809, but the pure alkaloid was procured by Reimann and Posselt, in 1827, by distilling the leaves with potassa or soda. The proportion of it varies very much in different kinds of tobacco. The Kentucky and Virginia and several European varieties contain from six to nearly eight per cent. in the thoroughly dried leaf; Maryland tobacco 2.29 and Havana less than 2 per cent. of nicotia (*Schloesing*). It is a thin, colorless, transparent liquid, which gradually grows yellow on exposure to the light and air, but is not entirely decomposed; it has, when warm, a moderately strong odor of tobacco, and a burning and persistently acrid taste. It is soluble in water, ether, alcohol, and the volatile and fixed oils. Heated on a platina plate, it is entirely driven off. It has an alka-

[1] Guibourt, Drogues Simples, 4ème éd., ii. 455.

line reaction, and, with acids, forms salts which are soluble in water and alcohol, but not in ether. It contains no oxygen.

INFUSUM TABACI.—*Infusion of Tobacco.*

It is prepared by adding sixty grains of tobacco to a pint of boiling water, macerating for an hour, and straining the infusion.

OLEUM TABACI.—*Oil of Tobacco.*

This oil is a product of the dry distillation of tobacco. It is a black, thickish liquid of an odor like that of old tobacco pipes.

UNGUENTUM TABACI.—*Tobacco Ointment.*

From half a troyounce of finely powdered tobacco a watery extract is procured by percolation and mixed with eight troyounces of lard.

VINUM TABACI.—*Wine of Tobacco.*

It is prepared by macerating a troyounce of tobacco in moderately fine powder in a pint of Sherry wine for seven days, with occasional agitation, then expressing and filtering the liquid.

History.—The specific name of the tobacco plant is derived by Neander, one of the earliest of the numerous writers upon the subject, from "*Tabaco*, a province of New Spain, situated about forty-four leagues from the city of Mexico, and which afterwards was called 'Our Lady of Victory,' in commemoration of a battle there won by Cortez, in 1519."[1] The generic title was conferred in honor of John Nicot, of Nismes, ambassador of France at the court of Portugal, in the year 1560. At Lisbon he was presented with a specimen of the plant, recently brought from Florida, and caused it to be cultivated in his garden. On returning to France he presented some of its seed to the Queen, who encouraged its culture. From these circumstances it was named *The Ambassador's Plant*, *The Queen's Plant*, etc., and, indeed, it was called by many other titles which have been forgotten, in favor of his whose influence chiefly promoted its cultivation in Europe. It would appear that the luxurious uses to which tobacco is at present chiefly applied, were but little regarded, until the return of Sir Francis Drake from Virginia, in 1586. This officer brought with him some of the pipes used by the aborigines, and so introduced the practice of smoking, which soon became fashionable under the patronage of Sir Walter Raleigh, and the gentlemen of the court. From thence, according to Murray, the practice was carried into the Low Countries by some young men who went thither to pursue their studies, and it soon spread itself throughout Europe. Cigar smoking was, however, already practised in Spain. The custom was introduced by the companions of Columbus, who had learned it from the inhabitants of Cuba, on the first discovery of the island, in 1492. The use of the plant appears to have been common throughout the American continent. It was found by Cartier, in Canada, in 1535, to be held

[1] Tabacologia: hoc est Tabaci seu Nicotianæ Descriptio, etc. Lugd. Batav., 1622.

in great esteem by the Indians, and a century later Hawkins described it as a favorite luxury of the natives of Florida. Although the use of tobacco rapidly became general, there were not wanting many writers to decry it, and attribute to its use a multitude of mischiefs. The Pilgrim Fathers of New England and their descendants distinguished themselves by enactments against the use of the weed. In the early days of the colonies, all minors were prohibited from using it, unless sustained by a physician's prescription; and to consume it in public subjected the offender to a fine. In Portsmouth, N. H., it was "ordered that a cage be built, or some other means devised, to punish such as take tobacco on the Lord's day in time of public service."[1] Even the royal pedant, King James, thought it matter of moment enough to employ his pen, and produced a violent diatribe against the offensive object, which proved his majesty a passed master in scurrility. Pope Urban VIII. excommunicated all smokers and snuffers, but Benedict XIII., who was an inveterate smoker himself, removed the interdict. Less exalted personages have emulated these examples in our own times, and with like results; in the present, as in the earlier age, fanaticism, by its excesses, kindles an excess of opposition, and aggravates the very evils it professes a desire to cure. Among other absurd stories which circulated in the earlier days of its history, tobacco smoking was accused of producing a sort of sooty deposit within the skullcap or in the brain itself![2]

Tobacco is now cultivated in almost every part of the world, and after having been rigidly interdicted by several governments of Europe, has become one of the most fertile sources of revenue. In France, for example, where the preparation and sale of tobacco is a government monopoly, the annual revenue was equal, in 1844, to twenty millions of dollars, of which sum three-fourths were clear profit, being nearly equal to the receipts from the tax on fermented and distilled drinks, and exceeding that of the impost on sugar. From 1811 down to the period mentioned, the receipts at the treasury from this source alone amounted to more than three hundred millions of dollars, a contribution voluntarily made to the State, increasing constantly, and averaging more than nine millions per annum. The consumption of tobacco in France, at the latest date mentioned, is estimated at one pound for every inhabitant, of which one-third represents the proportion of snuff used, and two-thirds that of smoking-tobacco.[3] Except sailors, scarcely any one chews the weed. In France it is still true, as Mérat wrote in 1821, that "the habit of chewing tobacco is confined to a small number of vulgar people who are, for the most part, addicted to intemperance."[4] These facts are of interest when it is attempted to estimate the mischief which the use of tobacco is alleged to produce,

[1] An Essay on the Influence of Tobacco on Life and Health. By R. D. MUSSEY, M.D., Boston, 1836.
[2] MANGETUS, Bib. Pharm. Med., ii. 940.
[3] MÉLIER, Rapport à l'Académie de Médecine. Bull. de l'Acad., x. 572, 1845.
[4] Dict. de Méd. en 60 vol., art. Tabac.

and they throw into stronger relief the evils which its abuse entails.

In more recent times a renewed interest has been given to the inquiry concerning the operation of tobacco on the human system, by the trial of the Count and Countess of Bocarmé, in Belgium, for the murder of the brother of the latter, by means of nicotia. This tragical event, which terminated in the execution of Count Bocarmé, took place in 1850.

Action. *On Plants.*—M. Mélier found that plants, such as the rose and orange, lose their foliage in the rooms where the fermentation of tobacco is carried on during the manufacture of snuff.

On Insects.—Nearly all insects shun tobacco; hence its use to preserve clothing, etc., from their ravages.

On Animals.—Herbivorous animals are not readily affected by tobacco; yet in excessive doses it appears in some instances to render their circulation irregular. Horses are said to be extremely fond of it, but in an overdose it poisons them. Dr. Mussey states that the infusion of tobacco has been known to destroy the life of a horse when forced into the stomach; and that a calf, washed with this liquid on account of vermin, died. Schubarth, in a series of twenty-two experiments,[1] upon horses chiefly, found that the action of tobacco on these animals was most strikingly indicated by the infrequency of the pulse, which fell from thirty-seven beats to twenty-six after the administration of about four ounces of powdered tobacco, and remained depressed for twenty-four hours. Murray relates that frogs placed in a glass vessel filled with tobacco smoke soon became intoxicated, panted, grew dull, and then soporose, and so died. A sparrow and magpies were killed in like manner. Brodie found that a strong infusion of tobacco produced death in dogs by arresting the action of the heart, while the empyreumatic oil killed the animals without at first, or immediately afterwards, arresting the pulsations of this organ. The symptoms produced by the tobacco were retching, vomiting, faintness, trembling, and, when the oil was employed, spasms and convulsions also, before death.[2] In 1833, Dr. Mussey performed a number of experiments on animals with the distilled oil of tobacco. He found that rats were far less susceptible than cats to the action of the poison, and, in general, that young animals were more so than the full grown. On examining the bodies of those which were rapidly killed by the poison, the blood was in no instance found to be coagulated.[3] In other respects his results coincide with those already detailed. Dr. Wright, of Birmingham (Eng.), found that from two to five grains of the essential oil of tobacco, given to dogs two or three times a day, induced gradual and complete marasmus; a peculiar dragging action of the hind legs, and loss of venereal power; softening and shrivelling of the testicles, shedding of the hair, and,

[1] Originally published in Horn's Archiv., 1824.
[2] Med. Repos., from the Philos. Magaz., Aug. 1811.
[3] Op. sup. cit.

before death, sloughing of the eyelids and blindness.[1] After death, the blood was invariably found fluid, deficient in fibrin, and particularly so in red globules; the heart was pale, soft, and smaller than natural; the body never stiffened, and decomposed very rapidly. The gums began to swell and bleed early in the experiments, and the teeth became loose and sometimes dropped out. The mucous membrane of the mouth, nose, and trachea was softer, more tumid, and more vascular than usual.

Nicotia acts poisonously on all animals. In fish it causes slow respiration, muscular paralysis, dilatation of the pupils, injection of the gills and also of the brain. Frogs resist its action longer, but gradually their breathing grows slow, and the heart loses its excitability; the fore feet are spasmodically retracted, the hind feet lie wrinkled and folded on the back.[2] According to Nunneley, one or two minutes after the injection of ♏ $\frac{1}{30}$ under the skin, the frog falls into a state of rigid spasm; shortly after the eye becomes insensitive, and twitches occur in the limbs, except into that in which the injection had been made, and in which the reflex power is abolished, although it is not so in the animal generally for from one to two hours. The heart beats regularly, but more and more slowly and feebly, until after death it remains in diastole filled with blood.[3] Some tobacco juice thrown into the mouth of a black snake, six feet in length, caused it to writhe spasmodically for a few moments, and then to become rigid, in which state it remained after death.[4]

The following are results of a carefully conducted series of experiments by M. Mélier: Nicotia was given to dogs or cats, generally by introduction into the subcutaneous cellular tissue, and in doses of from one to eight drops. The breathing was, in most of the cases, affected first, and is noted as difficult and anxious; the pupils were dilated, and the animals staggered in walking; violent efforts at defecation were observed in several cases, and a copious discharge of urine, apparently followed by relief; at a more advanced period there was vomiting and a slavering of frothy or ropy mucus; at variable stages from the commencement, agitation and trembling, and in several instances a lively movement of the ears; when death occurred it was immediately preceded by signs of complete exhaustion, and more remotely by convulsions. The exhaustion or paralysis appeared to affect the posterior extremities chiefly.

Very carefully conducted experiments were subsequently instituted, among others, by Albers, Kölliker, Bernard, and Van Praag. They agree in their main results, which may be thus epitomized:—

It is not true, as has sometimes been alleged, that nicotia acts as an irritant, and still less that it acts as a caustic, when applied to the skin, or even to the mucous membrane. It uniformly renders

[1] Am. Journ. of Med. Sci., Jan. 1847, from Med. Gazette, Oct. 2, 1846.
[2] HAUGHTON, Dublin Hosp. Gaz., Dec. 1856.
[3] Practitioner, v. 349.
[4] Bost. Med. and Surg. Journ., Oct. 1856, p. 216.

the respiration slower, after having, in some instances, increased its frequency. But the larger the dose administered the more speedily does the former effect ensue. The breathing has generally a very characteristic peculiarity, which consists in a hissing sound, and which is probably owing to a spasmodic contraction of the larynx and air-tubes.

The pulse, like the respiration, becomes slower after having been accelerated.

The muscular apparatus of various parts of the body is affected with alternate tonic and clonic spasms, and the eyeball generally protrudes, and is spasmodically drawn upwards and outwards. General relaxation succeeds these phenomena, with a tremulous movement of particular muscles, or of the whole body. In some cases which are more rapidly fatal, no spasmodic movements are observed, but immediate and complete prostration, with the tremulousness before mentioned. When the poison acts most promptly, the animal sometimes perishes without any convulsive or muscular agitation whatever.

In general, its application does not elicit signs of pain, and its effect in some instances is to destroy sensibility. The pupils are uniformly dilated under its primary action, but afterwards may become contracted.[1] Sometimes, but not generally, there is abundant salivation. In experiments which did not destroy life, and in those only, was there vomiting or purging; yet recovery is possible without these symptoms.

These results, which supply the deficiencies in the experiments performed by Mélier, without contradicting them, may be briefly stated as follows: Nicotia primarily lowers the circulation, quickens the respiration, and excites the muscular system, but its ultimate effect is general exhaustion both of animal and organic life.[2]

The dose of nicotia required to destroy life is extremely small. A single drop has killed a rabbit in three minutes and a half.

On Man.—The following phenomena, representing the physiological action of nicotia, were observed by Schroff in the experiments performed by his associates Dworzak and Heinrich. They correspond with those described by Reil in his own case. The dose of the alkaloid varied from $\frac{1}{32}$ to $\frac{1}{16}$ gr. diluted with a drachm of water. The minutest doses occasioned a burning sensation in the tongue, a hot, acrid irritation in the fauces, and, when larger quantities were taken, the entire length of the œsophagus felt as if it had been scraped with an iron instrument. Salivation was abundant. Even when very small doses were used, a sense of heat diffused itself from the stomach to the chest and head, and as far as the finger ends, accompanied by general excitement; even the smallest ones occasioned headache and a sensation, as of an *aura*, in the upper jaw; and the larger implicated the brain still more

[1] HIRSCHMANN, who performed a great many experiments on animals with this alkaloid, affirms that it always contracts and never dilates the pupil.—*Bull. de Thérap.*, lxv. 561.

[2] LEONIDES VAN PRAAG, VIRCHOW'S Archiv, viii. 56.

evidently, causing heaviness, giddiness, torpor, and sleepiness, indistinct vision, which was nevertheless attended with unusual sensibility of the eye to light, imperfect hearing, and a feeling as if the ears were stuffed with cotton, frequent and laborious respiration, oppression, and dryness of the throat. In forty minutes after the larger doses, a sense of unwonted debility and weariness was perceived, the head could scarcely be held erect, the face was pale, the features relaxed, the extremities became as cold as ice, and the coldness gradually advanced towards the trunk, and turns of faintness ensued with commencing insensibility and loss of consciousness. A disagreeable sensation in the stomach diffused itself upwards and downwards, accompanied by eructations, nausea, and even vomiting, which last generally procured some relief; a similar feeling extended through the bowels, the abdomen was distended, an urgent desire to go to stool was felt, and a discharge of wind and of some urine procured general relief. This was, however, of short duration. One of the experimenters was attacked, in the first half of the second hour, with peculiar clonic spasms of the whole body, which increased in violence during forty minutes, and lasted for an hour. The spasms began by a tremulous movement of the limbs, and gradually involved the whole muscular system, including, and chiefly affecting, the muscles of respiration. This act was oppressed and gasping, every respiratory movement being composed of a number of short and incomplete inspirations. The other experimenter, at this period of the operation, was affected with unusual muscular debility, very laborious respiration, and a rigor. In other respects his symptoms were the same. Both persons, on their return home, felt extremely weak, walked with ill-assured steps, and were very chilly; one of them had a return of the spasms and a frequent desire to pass urine, which was also very copious. The following night both were restless and almost sleepless, and the next day were still unwell, unable to apply the mind, tired, sleepy, and without appetite. The pulse continued weak and irregular, and three days elapsed before the effects were entirely dissipated.[1]

It might be expected that the workmen engaged in the manufacture of tobacco would exhibit on a large scale the action of this substance upon the economy. Happily there exist authentic documents illustrative of the subject, and which may be regarded as conclusively proving that many of the statements which have been made respecting it are either exaggerated or groundless. Ramazzini[2] describes the rude method of preparing snuff, which in his time was used in Tuscany, as occasioning violent headaches, nausea, and continual sneezing, among the workmen *who were not used to the occupation;* and Patissier, in his abridgment of the Italian author's treatise, says,[3] "The workmen in tobacco are generally thin, asth-

[1] Mat. Med. der rein. chem. Pflanzenstoffe, p. 234.
[2] Essai sur les Malades des Artisans, Trad. de Fourcroy.
[3] Maladies des Artisans, 1822, p. 202.

matic, and of a pallid or yellowish complexion, yet some there are who experience no evil consequences from their trade." Parent-Duchatelet and Arcet published a very interesting memoir upon this subject,[1] which has been considered as presenting it under too favorable a light, but without sufficient reason. The following statements contain the conclusions of these observers. They allege that in the greater number of manufactories there is no instance of a workman being unable to habituate himself to the emanations of tobacco. The breaking up of the bales is injurious to some of the men during the first two or three months of their employment. It is denied that the effects upon the functions of digestion and nutrition, described by Ramazzini and others, are in reality produced, unless in altogether exceptional cases, and that nervous affections are equally uncommon among the workmen. Manufacturing tobacco, it is maintained, in conclusion, neither injures the health nor shortens life. Dr. Ruef, physician to the government tobacco factory at Strasburg, affirms that the health of those even, among the workmen, who had been used to live in the open air does not suffer any injury. Only one process, that of fermentation, affects the less experienced among them, with headache, dizziness, tremulousness, vomiting, sweating, urgent thirst, and loss of appetite; but these symptoms, it is alleged, are transient and occasion no ulterior mischief. Dr. T. H. Babington relates the case of a man who was addicted to the inordinate use of tobacco, and at the same time was exposed for several hours daily to the fumes arising from tobacco while being "stoved." He suffered from excruciating pain in the head, had a pale, cold, clammy skin, contracted pupils; pulse 48; a strong smell of nicotia was exhaled by his skin, and was communicated to the steam from a vapor-bath with which he was treated.[2] Diseases among the workmen in tobacco are rare, and the average duration of their lives is fully equal to what is observed among other persons belonging to the same class of society. As an evidence that the emanations from tobacco are not injurious even to the fœtus, Dr. R. relates the case of a woman belonging to the factory who went to lie in at the Clinic of Strasburg. During her labor the waters, which were evacuated slowly, were observed to exhale a peculiar, strong, and penetrating odor, like that of fermenting tobacco. The patient, on being questioned, stated the nature of her employment, and thus furnished a probable explanation of the circumstance. The child was alive and vigorous. According to Dr. Ruef, chronic pulmonary affections are infrequent among tobacco workers, and he even affirms that some among them who enter the factory with emaciation, hæmoptysis, and cough, have there got rid of their pulmonic symptoms.[3]

A very interesting report on the sanitary relations of tobacco manufactories was made to the French Academy of Medicine by

[1] Annales d'Hygiène, etc., Avril, 1829.
[2] Dublin Quart. Journ., Nov. 1866, p. 545.
[3] Dierbach, op. cit., from Arch. Méd. de Strasbourg, 1835.

MM. Mélier and Loiseleur de Longchamps,[1] of which the prominent points are here presented in a summary form. The first impression upon those who become operatives in these establishments is always disagreeable, but especially so for the women; but this effect is temporary. After the acclimation, however, the health of many is, to a certain degree, impaired, and, in the course of two or three years, not a few acquire a dull, grayish tinge of the complexion, somewhat like that of anæmia, and remediable by the same means. It is in the fermenting rooms, where tobacco is prepared for making snuff, that its action on the health is chiefly, if not exclusively, shown. Nor is this surprising when it is considered that the workmen are obliged to separate masses of fermenting tobacco at a temperature of 144° F. Fatigue and heat are evidently here very prominent as morbific causes. The workmen believe that their occupation protects them from rheumatism and intermittent fevers, but Dr. Ruef, in a subsequent paper to that quoted above, discredits this notion. As respects the salutary influence of tobacco manufacture on consumption, five of the ten physicians attached to the national manufactures of France express an affirmative and two a negative opinion. At Bordeaux, according to M. Ruef in his later essay, consumption is unusual amongst the operatives, and the disease advances less rapidly in them than in patients placed under different circumstances. In nearly all the other establishments it is far less frequent than among the surrounding population, and, indeed, is in some quite unknown. The tobacco manufactures of Sardinia have been the subject of an interesting report by Dr. Berutti, professor of physiology in the University of Turin. The author comes to the conclusion that there is no disease among the workmen which can be fairly attributed to the peculiar influence of tobacco. He regards the cachexia described by the Parisian observers as independent of this cause, and concludes that inflammatory affections are really less frequent in tobacco factories than in others placed under like hygienic conditions.[2] M. Chevallier, in a statement relative to the tobacco workers in Belgium, presents the following summary of his researches: 1. It very rarely happens that the new hands in the factories do not become accustomed to their work in a few days. 2. The exceptions to this rule are quite inconsiderable. 3. Other things being equal, tobacco workers reach the average duration of life. 4. There is no example of a workman in the factories of Antwerp having perished from the exhalations of tobacco.[3]

The habitual use of tobacco by chewing, smoking, and snuffing is productive of peculiar effects, and, when carried to excess, of certain definite morbid states. *Chewing* tobacco in moderation has not been shown to be mischievous, however repugnant it may be to persons of refinement and delicacy. It is confidently believed

[1] Bull. de l'Acad. de Méd., x. 569, Avril, 1835.
[2] Bibliothèque du Médecin Practicien, xiv. 479.
[3] Bulletin de l'Académie de Méd., x. 787.

by many to promote digestion; and they find that a *small* piece taken after meals protects them from the unpleasant sensations in the stomach which, without this aid, they are apt to suffer. Very possibly the saliva which is secreted more abundantly under this stimulus may account for the alleged salutary effect. But if so large a portion of the weed is taken as to induce frequent and excessive spitting, the very reverse effect must ensue; the stomach is robbed of its natural excitant and a chief agent in digestion, the whole body is enfeebled by the waste of its fluids, and the nervous system sinks into debility under the constantly renewed alteration of stimulus and depression. And if the saliva is swallowed instead of being rejected, whatever is gained in cleanliness is lost in health, for the stomach and the entire system cannot long resist the impression of such doses of a virulent poison. In general, the excessive use of tobacco becomes mischievous both by the waste it causes of a precious animal fluid and by its direct influence upon the nervous and digestive apparatus. In both respects, chewing tobacco is infinitely the most hurtful mode of using it. The records of medicine, and especially those of America, abound in illustrations of the subject, for in no other country is the habit in question at all prevalent, except among sailors and others employed in the coarsest toil.

It would extend this article unduly were the observations of all the respectable authorities to be cited at length who have contributed to show the deleterious effects of chewing tobacco. Allusion will be made to some of the most modern and complete.

In the publication referred to above, Dr. Mussey presents a summary of the symptoms which he had himself observed, and illustrates it by the detail of several cases. A still more recent and complete description is contained in the narrative of nine cases published by Dr. Shipman.[1] The morbid symptoms were manifested chiefly by the nervous and digestive organs. The operations of the mind were neither so vigorous nor so clear as in the natural state; low spirits, irresolution, hypochondria, and gloomy anticipations beset the patients at all times, but were least tolerable during the process of digestion; nightmare, with an unusual exaggeration of its horrors, deprived them of repose at night, and by day, a fear of sudden death assailed them. The first slumber, instead of being the soundest and calmest of the night, was often postponed for several hours, and was even then unrefreshing. A singular sensation experienced by most of the patients immediately after going to bed is described as a "shock" at the epigastrium, such as a rush of blood to the part might be supposed to produce, or, as one person described it, like a discharge of electricity. This symptom is regarded by Dr. S. as pathognomonic. When the stomach was empty the patient experienced an intolerable sense of sinking at the epigastrium. Along with these symptoms palpitation of the heart, vertigo, and rushing of blood to the head, were

[1] Boston Med. and Surg. Journ., 1844.

commonly observed. Nearly all of the patients were emaciated and pale, and victims to the well-known symptoms of dyspepsia—acidity, cardialgia, gastrodynia, acid or watery eructations, and constipation. It is very remarkable that this frightful array of symptoms should gradually yield, and in a short time be entirely dispelled after the habit of using tobacco was abandoned. Several of the wan and wasted patients acquired a ruddy complexion and became quite stout. Dr. Chapman relates several striking instances of the pitiable results of the use of tobacco, some of which, indeed, exhibited a form of delirium like that produced by alcohol, although no spirituous drinks had been used.[1]

Dr. Le Briert has reported a case presenting the following symptoms, which he ascribes to the constant and inordinate habit of chewing tobacco. The patient, a woman, was almost speechless, the respiration sighing, the heart extremely feeble, the sight almost extinct, the hearing very dull, the face thin and haggard, the tongue red, tremulous, and dry, deglutition difficult, the abdomen retracted, the fæces scybalous, the appetite lost, and urination involuntary. In this condition death took place.[2] One reason, in addition to those mentioned, why the habit of chewing should be so much more mischievous than that of smoking tobacco is, that a very large proportion of the cigars in use are either made in the Havana, or out of the same varieties of tobacco which grow there. Now, as already stated, it results from several analyses that nicotia, the poisonous principle of the plant, exists in the Havana tobacco in the proportion of less than two per cent., while the Virginia, Maryland, and several European varieties contain from three to eight per cent. of this virulent poison.

The influence of *smoking* upon the system has been partially made the subject of accurate investigation by Dr. W. A. Hammond, who obtained the following general results:[3] It does not affect the secretion of carbonic acid through the lungs; it lessens the amount of aqueous vapor given off in respiration; diminishes the amount of the fæces, lessens the quantity of urine, and the amount of its urea and chlorine; and increases the amount of free acid, uric acid, and phosphoric and sulphuric acids, eliminated through the kidneys. Hence, it would seem to be probable that tobacco does not lessen the consumption of fat, but that it does retard the metamorphosis of the nitrogenous tissues. The increase of phosphorus and sulphur in the urine is probably derived from the nervous system, which tobacco so sensibly affects. Some of the morbid effects of smoking tobacco, when carried to excess, have been well depicted by Dr. Laycock.[4] He describes an inflammatory, but what is probably rather a congested, state of the mouth and fauces, in which sometimes the buccal epithelium exfoliates. If the throat be examined,

[1] Lectures on the Diseases of the Thoracic and Abdominal Viscera, p. 214.
[2] Edinb. Journ., x. 171.
[3] Am. Journ. of Med. Sci., Oct. 1856, p. 315.
[4] Lond. Med. Gaz., Oct. 1846.

it will appear slightly swollen, with congested veins meandering over the surface, and here and there a streak of mucus. This author thinks, also, that the posterior nares are probably in the same condition, and that the irritation is transmitted to the eye; undoubtedly this organ is frequently injected and watery in smokers, and often presents a spasmodic twitching of the orbicularis muscle. Mr. Lizars enumerates ulceration of the lips, tongue, gums, mucous membrane of the mouth, tonsils, velum, and pharynx, among the effects of this habit, and states that he attended a captain of the Indian navy, who fell a victim (from smoking cheroots) to ulceration of the mucous membrane of the left cheek, which extended backwards to the tonsils, velum, and pharynx, and which exhibited all the characters of carcinoma:[1]—which it probably was. Dyspepsia is occasionally met with as a consequence of excessive smoking, yet rarely in the aggravated form so common among chewers of the weed. Loss of appetite, constipation, hæmorrhoids, acne, and gumboils are ascribed to the same cause; it is more apt even than "chewing" to render the voice coarse, deep-toned, or smothered, and to prevent clear articulation by causing an excessive secretion of mucus in the fauces. Smoking tobacco also weakens the nervous system, inducing palpitation of the heart, tremulousness of the limbs, neuralgia, and morbid susceptibility, with diminished tone and power. These symptoms occasionally assume the aggravated form of angina pectoris, as M. Beau has pointed out,[2] and as we have witnessed in several cases. When too much indulged in, or when the nervous system is rendered impressionable by ill health, by losses of blood, or of any other fluid, or by over-excitement, smoking aggravates the already existing symptoms, and may induce that state of hypochondriasis which has already been described. One of its most usual effects is to produce an irregular and intermittent pulse. Mr. Lizars and others allege that it destroys the virile powers and sexual desire. All of the effects which, in this paragraph, have been ascribed to smoking tobacco, and many more besides, of like nature, are attributed by Erlenmeyer to the same cause. According to him, smoking cigars is vastly more injurious than smoking a pipe, because the preparation of tobacco for the latter purpose destroys as much as two-thirds of its nicotia, while the former loses but little of its active principle in the manufacture.[3] But the fact is overlooked, in this estimate, that the tobacco prepared for smoking in pipes originally contains a much larger proportion of nicotia than that of which the best cigars are made.

About 1860 a violent outburst of denunciation took place in England against tobacco-smoking, which finally assumed the form of a petition to Parliament. The blasts and counterblasts of public opinion appear to have thoroughly winnowed the subject; and its

[1] Times and Gaz., Aug. 1854, p. 146.
[2] Edinb. Med. Journ., Aug. 1862, p. 178.
[3] Prager Vierteljahrs., lxxxix., Anal., 116.

ultimate form may be represented by the conclusions of Dr. Richardson, of which the following is a summary: 1. The effects produced are very transitory. 2. The evils of smoking are functional in their character, and statements that it causes "insanity, epilepsy, St. Vitus' dance, apoplexy, organic disease of the heart, cancer, and consumption," are devoid of truth. 3. The habit of smoking is deleterious to the young. 4. Tobacco is a luxury, but is probably one of the least hurtful of luxuries.[1] There are several diseases, however, not enumerated by Dr. Richardson, which excessive smoking unquestionably develops. One of these is amaurosis, many cases of which have been traced to tobacco-smoking by no less competent authorities than Mackenzie and Sichel. The former many years ago "hinted his suspicion" that it is "a frequent cause of amaurosis,"[2] and the latter was of opinion "that there are few persons who have smoked during a long period more than five drachms of tobacco per diem, without having their vision and frequently their memory enfeebled.[3] A case of impaired vision from the same cause with general anæsthesia, and occasioned by immoderate smoking, is related Dr. Farnsworth. In spite of a well directed treatment the disease grew worse, until the discovery was made that the patient was in the habit of smoking a pipe almost continually with the coarsest kind of tobacco. On relinquishing this practice he gradually recovered.[4] A striking example is reported of this affection, under the care of Mr. Wordsworth, in whose opinion it is incurable.[5] Mr. W. has also published three cases illustrating the production of amaurosis by tobacco, and he states that he has seen a considerable number of others.[6] It is worthy of remark that, in most of these instances, a pipe was smoked with the strongest kind of tobacco. Mr. Hutchinson, after an interesting analysis of numerous cases of amaurosis, is disposed to consider tobacco as a frequent cause of the disease when it occurs in a symmetrical form ;[7] and Sichel has expressed the opinion that few persons can long continue the consumption of three hundred grains of tobacco daily without an impairment both of sight and memory.[8] The form of paralysis known as *dropped hands* has been ascribed to the abuse of tobacco, but is much more probably due to the lead with which the prepared weed was impregnated, as in the case of poisonous snuff described below.

The common practice of smoking immediately before going to bed is certainly soothing to those who have toiled all day, and it perhaps affords them the only hours of really calm enjoyment in life. But to one excited by annoyances, weakened by ill health, or rendered susceptible by a too close application to study, the evening cigar is a certain foe to sleep, the restorative which he stands most in need of; he remains helplessly awake, or, after passing a restless

[1] Lancet, July, 1836, p. 73.
[2] Dis. of the Eye, 1835.
[3] Br. and For. Med.-Chir. Rev., July, 1863, p. 265.
[4] Am. Med. Times, Oct. 1862, p. 189.
[5] Times and Gaz., April, 1863, p. 345.
[6] Lancet, July, 1863, p. 95.
[7] Lond. Hosp. Reports, i. 7.
[8] Annuaire de Thérap., xxiv. 103.

and dreamy night, he rises enfeebled and unrefreshed.[1] It is often objected to the practice of smoking that it begets a fondness for strong drink. Water seems mawkish to the palate of the smoker, and he moreover feels instinctively that whatever is unpleasant in the effects of tobacco is neutralized by alcoholic beverages, while the stimulation of these liquids is moderated by the sedative action of the weed. The two articles mutually counteract each other. It does not appear, moreover, that either of them, used to excess, leads to a corresponding intemperance in the use of the other.[2]

Snuffing is a form of using tobacco which, however it may offend delicacy, is not chargeable with the same mischiefs as those which have been considered. It blunts the senses of smell and taste, and alters the voice, and, further, by passing into the stomach the particles of snuff may give rise to dyspepsia, yet seldom in a very aggravated form. Dr. Prout, however, goes so far as to assert that he has seen this affection terminate in malignant disease. There can be no doubt that nicotia has been extracted from all the organs of a person addicted to the immoderate use of snuff.[3] Snuff is sometimes adulterated with acetate of lead for the purpose of giving it more piquancy. Four examples are reported by M. Meyer, of Berlin, in three of which the specific form of colic, and in all paralysis of the extensor muscles, were present.[4] A case of colic and general lead poisoning from this cause is also related by E. Mayer, of Halle.[5] Alfter reports a case of chronic lead poisoning from snuff which was found on analysis to contain two and one-half per cent. of the metal.[6] Snuffing is a habit more inveterate, perhaps, than either of the remaining modes of using tobacco. A singular illustration of its empire is furnished by Mérat.[7] "I was walking," he relates, "in the forest of Fontainebleau, when I found a man stretched upon the ground. I supposed that he was dead, but on approaching him he asked me in a plaintive tone if I had any snuff, and on my replying in the negative he fell into his original state. It did not cease until I brought a wood-cutter to the spot, who gave him several pinches of snuff in succession. He then related that he had set out in the morning, supposing his snuff-box to be in his pocket, and that after he missed it he had walked on as long as possible, but at last his longing for it became so intense that he was unable to move a step further."

[1] Willis, in his *Practice of Physic*, alludes to this double operation of tobacco. He says: "It doth not only procure sleep alone, but sometimes also the contrary of it, which is watchfulness."—*On the Operation of Medicines*, 1684, p. 140.

[2] In the *Bibliotheca Pharm. Med.* of Mangetus, the following rational conclusion is stated. After rehearsing some of the alleged mischiefs of smoking, the author concludes: "Non inde tamen sequitur fumum nocivum esse, cum multos novimus qui hodie et copiose per plures annos eo usi sunt, sanos tamen et validos vitam ad extremam senectutem produxisse, nec ullum inde incommodum sed potius maxime juvamen precepisse: aliis enim ventriculum refocillat, et concoctionem promovet, aliis alvum leniter solvit; alii nullum inde commodum at neque damnum sentiunt quibus usus ejus adiaphorus est."

[3] Bull. de Thér., lxii. 88.

[4] Virchow's Archiv, xi. 209.

[5] Journ. f. Pharmakodyn., ii. 221.

[6] Henle's Zeitschrift, 1859, p. 158.

[7] Dict. de Méd., tom. liv.

In estimating the influence of tobacco upon the health, the power of habit is not to be neglected. It is this, doubtless, which explains in part the striking difference between the effects it produces upon the novice and upon the expert in its use. But it should also be borne in mind that the former, out of awkwardness, is apt to allow the juice of the tobacco to enter his stomach, or the smoke to penetrate his lungs, while the adept seldom does either, but expectorates the one, and by an automatic action of the muscles of the fauces excludes the other from the trachea. To really inspire the smoke of a pipe or cigar may be learned and practised with impunity, but there are few even among veteran smokers who can accomplish the feat without serious inconvenience.

The *poisonous* action of tobacco might be illustrated by a great number of cases, but the following summary of its symptoms will render the subject clearer. An overdose gives rise to malaise, nausea, vomiting, a burning heat in the throat and stomach, colic, diarrhœa, urination; extreme giddiness, great anxiety, with a disposition to faintness, pallor, coldness of the extremities, spasmodic trembling; the pulse is small, weak, tremulous, and intermittent; the breathing labored and stertorous; there is a paralytic relaxation of the voluntary muscles, and clonic spasms of the limbs. The pupils are but slightly affected, and the eyes seem to be sensible to light. This state is succeeded by a general torpor, or utter prostration, which is not coma, but which may terminate in death. It was, perhaps, the fact that these symptoms are so directly the opposite of those produced by nux vomica which led to the suggestion of tobacco as a remedy for poisoning by this agent and its preparations. In the West Indies it is said to be employed to prevent and cure the tetanus which is so fatal among negro infants.[1] Upon certain persons, and under certain circumstances, the mere emanations of tobacco produce alarming symptoms. A Mr. Howison went to sea in a schooner laden with tobacco, and in the evening was shown to his sleeping place in the cabin. He felt its atmosphere close and suffocating, but went to bed. About midnight he awoke in a cold sweat, and unable to speak or move, but his mind remained clear. In this state of conscious trance he is stated to have continued until the following afternoon, when a storm took place, and roused him so that he was able to reach the deck, where the cold dash upon his head restored him to himself.[2] Ramazzini saw a girl present symptoms of poisoning, and discharge blood from the bowels, in consequence of her having remained too long among packages of tobacco; and another one is stated by Fourcroy to have died in convulsions from a similar cause.[3]

The *external* use of tobacco and its preparations has also occasioned alarming accidents. Dr. Mussey assures us, on the authority of a medical friend, that the latter "was once thrown into a state of great prostration and nausea from having a part of his

[1] SOBERNHEIM, op. cit. [2] SIGMOND's Lectures, Lancet, May 13, 1837.
[3] MÉRAT and DE LENS, op. cit.

hand moistened, for a few minutes, in a strong infusion of tobacco." The same author relates that, during the last war with England, "the soldiers under hard service on the Canada frontier, not unfrequently disabled themselves for duty by applying a moistened leaf of tobacco to the armpit. It caused great prostration and vomiting."[1] Alston mentions a similar case, and adds that he knew a small bit of tobacco put into the nose only, cause sickness, vomiting, and purging pretty severely.[2] A smuggler covered the whole of his naked body with tobacco leaves, with a view to defrauding the revenue of the amount of the duty. The tobacco, moistened by perspiration, produced through the skin a real poisoning.[3] An interesting case of poisoning by the application to a ringworm of the "strong juice" of a tobacco pipe, is related by Dr. Mussey. The instant the oil was applied the eyes of the little patient were rolled up in their sockets, and she reeled and fell backwards. The usual symptoms followed, yet the child survived, but continued feeble and sickly, and during four or five years was subject to prolonged fainting fits. Dr. Westrumb met a case almost precisely similar, except that the patient was a man, and the symptoms, which were also less violent, were dissipated in a few hours by a strong infusion of coffee.[4] A child had a portion of the deposit in a pipe mixed with oil and applied to a ringworm upon the neck. Soon afterwards she complained of a sense of choking, tottered in her gait, and vomited. Ammonia and coffee were administered, and the child recovered.[5] Calosi reports that a young man affected with *herpes tonsurans* applied some empyreumatic oil of tobacco to the eruption, at the suggestion of a quack, and in the course of two hours was seized with a chill, cold sweat, and faintness, followed by diarrhœa, vomiting, and delirium. Under the use of diffusible stimulants he recovered.[6] Other preparations of tobacco employed to cure eruptions of the scalp, or to remove vermin, have sometimes occasioned grave and even fatal results. Such an instance is that of three children whose heads had been rubbed with an ointment of the sort; they were presently attacked with vertigo, excessive vomiting, sweating, and fainting, and for twenty-four hours staggered like drunken persons. They were restored by rest, and the use of lemon syrup.[7] A similar case is related by Dr. Truchsess, in which snuff was strewn upon the scalp of a girl affected with tinea favosa; in about eight or ten hours the characteristic symptoms of tobacco poisoning made their appearance, and brought the little patient within a hair's breadth of death.[8] Several authors narrate examples of an analogous description of poisoning, namely, by tobacco lotions employed to cure the itch. One of the mildest of these deserves notice on account of the diuresis which characterized it. The patient had his body and extremities bathed every night and morn-

[1] Op. sup. cit.
[2] Materia Medica, ii. 190.
[3] DECAISNE, Edinb. Journ., x. 172.
[4] DIERBACH, op. cit., ii. 889.
[5] Lancet, June, 1869, p. 843.
[6] Abeille Méd., xv. 311.
[7] MURRAY, Apparat. Med., i. 686.
[8] DIERBACH, loc. cit. See another case in SIGMOND's Lectures.

ing with a decoction of half an ounce of tobacco in a pint of water. The second day nausea and diuresis occurred, and the amount of urine discharged greatly exceeded that of the patient's drinks. There was a constant taste of tobacco in the mouth, and occasional vomiting.[1] A man and his wife suffering from the itch rubbed themselves from head to foot with a decoction of tobacco. The man's face was pale, and his skin covered with a viscid sweat; when roused from his stupor he complained of severe gastric pain, was very cold, and had frequent calls to urinate; the limbs were tremulous and affected with severe cramps; he was very sick at the stomach, vomited, and had watery dejections; the pulse was slow, thready, and feeble. Both patients recovered.[2] A patient of Dr. Wright, of Birmingham, was induced by an acquaintance "to sit over a chamber-pot containing half an ounce of tobacco with some burning coals thrown upon it, to ease himself of piles." After sitting a few minutes he fell in a state of utter prostration, pale, and perspiring abundantly, and without any sign of life except a deep sigh every fifteen or twenty seconds. On his recovery he stated that he was perfectly sensible, during the greater part of the time, to all that was passing around.[3]

The *internal* use of tobacco in excessive doses gives rise to still more marked symptoms of poisoning than occurred in the above recited examples. A fatal case is reported by Mr. Skae,[4] of a man who swallowed a large mouthful of crude tobacco. He became suddenly insensible, motionless, and relaxed, with contracted pupils, and a scarcely perceptible pulse. There succeeded to these symptoms convulsions, loud cries, and dilated pupils; active vomiting and purging took place, but death by syncope, or exhaustion, ultimately occurred. On dissection, the body was found to be rigid, the stomach ecchymosed, in the intestine a bloody liquid, and dark fluid blood was in the heart, veins, and aorta. Several other cases, produced by a similar cause, and which terminated in recovery, differ from the above chiefly in the absence of convulsive movements.[5] Even smoking has been known to produce dangerous and even fatal illness. A man in a single afternoon smoked twenty pipes for a wager, and fell into a lethargic condition; and two brothers, one of whom smoked seventeen and the other eighteen pipes, died in a condition resembling apoplexy.[6] Marchant relates the case of a smoker who accidentally dislodged from his pipe, and swallowed, a plug of inspissated tobacco-juice; after the ordinary symptoms he fell down insensible, and would probably have so died, had he not accidentally been seen and relieved.[7] A

[1] BARBIER, Mat. Méd. iii. 463. For other cases see MURRAY, loc. cit., and DUNCAN's Med. Comm., xi. 327.
[2] Bull. de Thérap., lxxvi. 525.
[3] Lond. Med. Gaz., Oct. 1846, and Am. Journ. of Med. Sci., Jan. 1847.
[4] Edinb. Med. Journ., i. 643.
[5] N. Jersey Med. and Surg. Reporter, x. 117. Journ. f. Pharm., etc., i. 568.
[6] MURRAY, loc. cit.
[7] Brit. and For. Med.-Chir. Rev., April, 1866, p. 543.

remarkable case, which fell under the notice of Dr. Marshall Hall, was that of a young man, a novice in the practice, who had smoked one and a part of a second pipe, but without the usual precaution of spitting out the saliva. He became affected by alarming syncope, retching and vomiting, soon after which he returned home, went to bed, and was seized with stupor and laborious breathing. Then followed pain in the head, congestion of the face; the right pupil was exceedingly contracted, and the left much larger than usual, and both were insensible to light. The whole muscular system was affected with spasmodic contraction. The breathing was stertorous, the pulse natural.[1] It is difficult to account for the symptoms observed in this case, without supposing that those which occurred after the patient reached his bed were attributable to an attack of congestion of the brain accidentally developed by the sickness which the tobacco originated. They certainly bear very little resemblance to the poisonous effects of this drug, which, as may be inferred from what has been already stated, are singularly uniform and characteristic. Yet there is another case on record which presented symptoms closely resembling those just described, and it is the more remarkable because the same poisonous cause acted at the same time and equally upon two persons of whom the one was affected after the wonted manner, but the other presented the following symptoms: She fell insensible from her seat, was seized with convulsions, her cheeks were deeply suffused but cool, the carotids throbbed, and the jugular veins were distended; the eyes were wide open, but the white only was visible; the pupils dilated and insensible to light; the conjunctiva injected; the head drawn spasmodically backwards; the respiration slow; the pulse slow, hard, and full; the toes and fingers cold; from time to time there were clonic spasms of the extremities, with a tendency to opisthotonos; and insensibility was complete.[2] The patient is here described as being of a *sanguine* temperament; her symptoms were closely analogous to those in the previous case, and, like them, are quite exceptional in the history of poisoning by tobacco.[3]

The greater number of *fatal accidents* from tobacco are to be found among cases in which it has been used as an enema in strangulated hernia and other obstructions and affections of the bowels. An instance is related in which a strong enema was administered for tapeworm, and immediately after receiving it the patient died; in another the same result took place in fifteen minutes; in a third in three-quarters of an hour, etc. In these, and in many equally disastrous examples which it is unnecessary to relate, the quantity of tobacco used in preparing the clyster was generally large, from half an ounce to two ounces, but much less has sometimes proved fatal. A case was submitted to judicial investigation in which

[1] Practical Observations and Suggestions, 1845, p. 171.
[2] DIERBACH, op. cit. See also a case in BARBIER, iii. 462.
[3] The reader is referred, for a further discussion of the subject, to the Essays of Mr. JOHN LIZARS, *The Use and Abuse of Tobacco* (Reprint), Philad., 1859; and Dr. A. BLATIN, *La Nicotine et le Tabac*, Paris, 1870.

two drachms destroyed life:[1] Dr. Copland witnessed a fatal result where *thirty grains* infused in a pint of water were administered to a patient in an advanced stage of ileus;[2] and Dr. Tavignot a like event in the case of a robust man, fifty-five years of age, for whom an enema containing *fifteen grains* of tobacco was prescribed for the purpose of destroying ascarides.[3] Dr. Eberle says:[4] "I have known an empiric destroy, in less than twenty minutes, the life of a charming little boy by an immoderate injection of the infusion of tobacco."

Nicotia is one of the most potent of poisons. Its physiological action, as has been shown already, presents no essential points of difference from that of tobacco itself, or of its essential oil; but when administered in sufficient quantity to destroy life, its fatal effects are produced in less time than those of any other poison, except prussic acid. In the famous case of Count Bocarmé, his victim appears not to have survived more than five minutes the administration of the poison; and Orfila affirms that perfectly anhydrous nicotia in sufficient quantity may destroy the life of a man in two or three minutes.[5] Mr. Taylor, in commenting on a case of suicide by this substance, concludes that the person "became insensible and powerless within a few seconds, and that he died in from three to five minutes."[6] In this case death took place quietly and without convulsions. Another case of suicide by nicotia occurred at Cherbourg, in 1859. The rigidity of the body was very protracted, and the skin of a dull hue.[7]

Remedial Employment.—The distressing symptoms which, even in moderate doses, it occasions, the risk of fatal consequences, and the uncertainty in regard to the degree of its influence upon individuals, have tended to restrict the medicinal employment of tobacco within comparatively narrow limits. Yet, as the virtues of the drug cannot be denied, and as it is not more dangerous to life than several of those which are commonly prescribed, it ought not to be excluded from use on account merely of its repulsiveness. Its virtues are both peculiar and unequivocal.

External Use.—Preparations of tobacco have for a long time been used for cutaneous eruptions and parasites. In Hungary, a strong decoction of the plant is a popular remedy for the itch among sheep, and for the scab to which these animals are subject. An infusion, decoction, or ointment of tobacco has been successfully employed by numerous physicians as a remedy for the *itch.* Dodoens, Boerhaave, Coste, Fournier, Beçu, and others have recommended it strongly, and Dubois, from whom this statement is borrowed, affirms that he has found it very efficacious in the form of a decoction in which sal ammoniac and sea salt had been dissolved, and which he applied three times a day.[8] Unless the erup-

[1] Barbier, ii. 888.
[2] Dict. of Pract. Med., Am. ed., i. 443.
[3] Gazette Méd. and Rev. Méd., Nov. 1840.
[4] Therapeutics, p. 389.
[5] Toxicologie, 5ème éd., ii. 513.
[6] Guy's Hosp. Rep., 3d ser., iv. 352.
[7] Annales d'Hygiène, Avril, 1861, p. 404.
[8] Mat. Méd. Indigène, p. 225.

tion were very limited, this method is scarcely to be recommended while so many more efficient ones exist. That it is dangerous is attested by numerous cases, of which several have been already cited. *Prurigo*, *pityriasis*, and some other cutaneous eruptions, have also been treated by tobacco. Bruised leaves of the fresh plant have been recommended as an application in urticaria, and in several painful disorders. They also speedily relieve the stinging of nettles. In *gout* this is an old remedy, but physicians of our own time have found it useful. Dr. Vetch, of London, highly recommended it as palliative of the pain in this disease and in *articular rheumatism*,[1] and other authorities have given it a like commendation. The fumes of burning tobacco have been employed for the same affection, and commended by Réveillé Parise,[2] and by Hinard,[3] in gout. The affected part is directed to be held over a pan of burning coals upon which portions of tobacco are thrown from time to time, while the inflamed joint is gently rubbed with flannel. The operation should continue for eight or ten minutes, and be repeated two or three times a day. The palliation of the pain is asserted to be immediate and very considerable. Tobacco applied to the epigastrium has been employed to excite vomiting in *poisoning with opium*, when the stomach had become insensible to the action of emetics given by the mouth. *Nasal polypus* has been gradually but thoroughly cured by the use of strong snuff. A remarkable example of the sort is reported by Dr. Townsend, of New York.[4] The same agent has been employed to palliate chronic inflammations and discharges from the nasal passages, as well as to destroy the *worms* which, in tropical climates, sometimes breed in the antrum highmorianum and adjacent cavities, causing intense suffering and destruction of the bones.[5] In some experiments upon these animals with various liquids, Dr. Kilgour found that a decoction of tobacco was instantly fatal to them. Catarrh of the Eustachian tube and of the tympanum may sometimes be improved by the patient's forcing tobacco smoke through the former passage while the mouth and nose are securely closed.[6] Chronic inflammations of the eyes are occasionally benefited by the habit of snuffing, which promotes the flow of tears and nasal mucus.

Internal Use. Diseases of the Nervous System.—It is in this class of diseases that tobacco has gained its greatest reputation as a remedy. In purely nervous or spasmodic *cough*, which comes on with a sense of heat or tickling in the windpipe, the paroxysms can generally be warded off by inhaling two or three draughts of tobacco smoke. According to Pittschaft, Fischer, Wolfsheim, and others, whooping-cough is efficiently treated by this agent, which is alleged to shorten the paroxysms and render them less violent.[7]

[1] SIGMOND, op. cit.
[2] Bull. de Thérap., ii. 79.
[3] Ibid., xxiv. 287.
[4] Med. Recorder, iv. 147.
[5] DUNCAN'S Med. Comm., viii. 75. Compare also SIMON-PAULLI, Comm. de Abusu Tabaci. Argentorati, 1665, p. 3.
[6] TROUSSEAU and PIDOUX, op. cit.
[7] DIERBACH, loc. cit.

But these effects, at least, can be obtained from belladonna and other medicines, without the concomitant inconvenience of tobacco. In *spasmodic croup*, smoking a cigar has been found adequate to arrest the paroxysm by producing nausea.[1] Vanderburgh and Godman found the same disease to yield to a plaster made by strewing Scotch snuff on a piece of greased linen, and applying it to the throat and sternum.[2] This application is said to cause neither vomiting, vertigo, nor any other distressing symptom; nevertheless it is hardly to be recommended when the patient is either very young or of feeble constitution. Dr. Wood[3] states that one of the worst cases of *spasm of the glottis* which he had seen, and which resisted powerful depletion by the lancet, yielded to the application of a tobacco cataplasm to the throat. In a case of chronic *singultus*, in which all the usual remedies had failed, the patient was directed to swallow tobacco smoke, which soon arrested the symptom. The spasmodic muscular contraction which retains a *dislocated jaw* in its new position has been overcome by causing the patient to inspire tobacco fumes until nausea was produced. Tobacco has been included in the long list of cures for *epilepsy*. Pitschaft regards it as a precious remedy in epilepsy, catalepsy, hysteria, and idiopathic tetanus; but his opinion is derived from theoretical considerations, and is not supported by experience. It is possible, however, that when epilepsy is produced by onanism it may sometimes be cured by tobacco, for, as previously stated, and as Dr. Fischer, of Dresden, has remarked, the use of tobacco allays sexual lust.[4]

Tetanus.—Tobacco should rank next to opium in the treatment of this affection, for its success is hardly less equivocal, although its mode of action renders it perhaps less eligible. Tobacco appears to have been used in the last century, and indeed in the early part of the seventeenth century, for idiopathic tetanus, but the first authentic mention, it is believed, of its successful employment in the traumatic affection was made by Mr. Duncan in 1815,[5] who, while in Granada, cured this disease in a negro whose foot had been lacerated by an iron cylinder. He employed tobacco smoke. In 1822, Dr. Anderson, of Trinidad, cured five cases of traumatic tetanus by the use of tobacco in fomentations, cataplasms, and injections.[6] In 1825, Dr. B. Smart, of Maine, reported a very interesting case of tetanic spasm produced by an accumulation of *clay* in the intestines, and which was at first relieved and ultimately cured by tobacco enemata.[7] Dr. O'Beirne[8] cured a case of this affection, after six weeks' treatment, chiefly by the use of tobacco; in 1826 a case was published by Dr. Briggs,[9] which was reported to him as somewhat rudely, but successfully treated by the same

[1] Dr. Chapman, Am. Journ. of Med. Sci., i. 477.
[2] Ibid., ii. 480.
[3] U S. Dispensatory.
[4] Dierbach, loc. cit.
[5] Edinb. Med. and Surg. Journ., xi. 198.
[6] Trans. Med. Soc. Edinb., i. 184; ii. 365.
[7] Am. Journ. of Med. Sci., vi. 337.
[8] Dublin Hospital Reports, iii. 343.
[9] Ibid., xxv. 303.

agent; and in the same year Dr. Jackson (of Northumberland, Pa.) published an equally fortunate result in a case of traumatic tetanus, obtained by the application of tobacco to the wound and to the epigastrium of the patient.[1] Mr. Bullock reports the cure, by means of tobacco enemata, of a very severe case of the disease, occasioned by a blow upon the side, which made no external wound.[2] More recently an instance of traumatic tetanus cured by tobacco enemata has been reported by Mr. Pridie,[3] and another under the care of Mr. Simon, in which nicotia was used. The dose of this remedy employed was at first one-twelfth of a minim, which was gradually increased to one-sixth of a minim.[4] The share of the medicine in the cure was not very evident. Several of the above cases are included in the nineteen which the table published by Curling contains.[5] Of the sensations caused by tobacco this author remarks that they are so peculiarly distressing that, after its full effects have been produced, patients will hardly submit to a repetition of them. Of the nineteen cases collected by Mr. Curling, nine recovered, and the remainder were for the most part feebly impressed by the remedy, or were brought under its influence at too late a period of the disease. He recommends that the dose at first should be just sufficient to act upon the system, and that afterwards it should be increased in order to maintain the impression; and he assures us that he did not succeed in finding a single case in which, when fully and fairly tried before the powers of the constitution had given way, it had been known to fail. Without maintaining that the remedy will always avail, Dr. C. holds it, with good reason, to be the best that we at present possess. He is of opinion that not more than a scruple of tobacco leaf, infused in eight ounces of water, will be enough for an injection, which must afterwards be increased in strength in proportion to its effects. In the very year when Mr. Curling's essay was published, a memoir "On the Employment of Tobacco in the Treatment of Tetanus" was transmitted to the Royal Academy of Medicine by M. Cavenne, of Martinique.[6] The writer appears to have been quite ignorant of what had already been written upon the subject, and to have thought of tobacco as a substitute for opium at a time when none of the latter was at hand. A portion of his cases were of idiopathic and a portion of traumatic origin, and the form he adopted of administering the medicine was by injection. It would appear that all of the cases terminated favorably. Nicotia has been employed in tetanus in several cases besides that already cited, some of which are reported by Prof. Haughton,[7] and one of singular severity by Mr. Tufnell, of Dublin.[8] The medicine was administered in doses of one drop every two hours. Its taste was found extremely repulsive, and it

[1] Med. Recorder, x. 315.
[2] Lond. Med. Gazette, July, 1841.
[3] Month. Journ. of Med. Sci., March, 1846, p. 650.
[4] Times and Gaz., July, 1858, p. 112.
[5] A Treatise on Tetanus. London, 1836.
[6] Bull. de l'Acad., i. 193.
[7] Dublin Quar., Aug. 1862, p. 172.
[8] Am. Journ. of Med. Sci., April, 1863, p. 496.

occasioned, along with relaxation of the spasms, profuse vomiting and perspiration. When it could no longer be administered by the mouth in consequence of rigidity of the jaws, it was given by enema in doses of two drops at the same intervals as before. Fifty-six drops in all were taken. In deciding whether to employ opium or tobacco in a case of tetanus, the safest guide would appear to be the constitution of the patient. If he is of a robust and healthy constitution, the speedier and safer course of cure would be by tobacco; but in opposite conditions the use of this remedy would involve some risk. It is probable, also, that tobacco is more especially indicated at the commencement of the attack, before the powers of life have begun to fail; in an advanced stage the propriety of using it is very questionable.

Poisoning by Strychnia.—In 1856, the Rev. Prof. Haughton published an account of some experiments illustrating the antagonism of nicotia and strychnia, and in 1857 Dr. O'Reilly, of St. Louis, cured a person who had taken six grains of strychnia, by means of a strong infusion of tobacco.[1] A boy who had swallowed about four grains of strychnia was successfully treated by the same method in the hands of Dr. Smyly.[2] A girl eleven years of age, who attempted to destroy her life by taking three grains of strychnia, and in whom the characteristic action of the poison was highly developed, recovered under the use of an infusion of tobacco.[3] These cases, taken in connection with the illustrations already given of the curative power of tobacco and its alkaloid in tetanus, prove their inestimable value in two affections of the most formidable character and the least amenable to medical treatment.

Diseases of the Digestive System—Constipation, Hernia, etc.—Authors have described the virtues of tobacco in "constipation," in "ileus," and in "hernia," but, if we except external strangulated hernia, without clearly distinguishing the anatomical conditions to which they applied these names. It is not easy, and perhaps is not possible, to determine what was the actual condition of the intestines in any of the cases which terminated favorably, since the symptoms presented in all of them do no more than indicate an obstacle to the passage of their contents through the bowels, and in some cases inflammation of the peritoneum besides. Yet in all of the forms of obstruction elements exist for the removal of which tobacco forms an appropriate agent; for should the obstacle consist of that somewhat hypothetical condition called spasm of the bowels, nothing could promote its thorough relaxation better than tobacco; if an accumulation of fæces is the impediment to a normal action of the intestinal canal, the same remedy must operate favorably by promoting relaxation of the bowel, and at the same time by dissolving its contents with the augmented secretion; should a true hernia exist within the abdomen, or appear externally, tobacco must contribute to making the protruded bowel resume a natural

[1] RANKING'S Abs. (Am. ed.), xxix. 287.
[2] Dublin Quart. Journ., Aug. 1862, p. 183.
[3] Brit. and For. Med.-Chir. Rev., Jan. 1867, p. 243.

condition, not by relaxing the spasm which has been imagined to account for its stricture and incarceration, but by exhausting the protruded portion of fluids, diminishing its bulk, therefore, and consequently facilitating its return; or, finally, when the bowel is contracted by being twisted upon itself, by intussusception, by an interstitial deposit, by the pressure of a tumor, by fibrinous deposits and adhesions between adjacent surfaces of the peritoneum, or when it is occluded by a foreign body, the several modes of action enumerated may concur in overcoming the obstacle to the passage of the intestinal contents. The only remaining condition which produces symptoms of intestinal obstruction is simple and passive dilatation, tending to softening or to gangrene of the bowel, a state which has been well described by Abercrombie, but has no distinctive symptoms. In it, doubtless, the operation of tobacco would either be negative, or, more probably, mischievous, for the essence of the disease seems to be paralysis of the muscular coat of the intestine.

Sydenham was one of the first authorities to recommend tobacco in obstruction of the bowels, but he seems to have employed it only as a last resort, and after the failure of bleeding, purges, and opiates. He directs tobacco smoke to be forced up the bowel through a pipe from a large bladder, and to be repeated after a few hours.[1] A physician of Paris, who was paralytic during the last seven or eight years of his life, found the only effectual means of procuring an evacuation from his bowels to be a tobacco enema, which he took at intervals of ten or twelve days.[2] An interesting case is related by Turner,[3] of a sailor who, in consequence of a penetrating sword wound of the belly, was unable to have any movement of the bowels, in spite of various emollient and laxative clysters, until the fumes of tobacco were injected into the bowel, which presently procured an evacuation. In his admirable work on diseases of the abdomen, Abercrombie says of the tobacco injection: "As far as my observation extends, it is the remedy of most general utility in all forms and stages of ileus;"[4] and he adds that, with the precautions laid down by him, he has never seen any unpleasant effect from the free use of this powerful agent. Dr. A. recommends as the best mode of employing it, that not more than fifteen grains, infused for ten minutes in six ounces of boiling water, should be given, and, after an hour's interval, if no result occurs, that it should be repeated in the quantity of twenty grains, and so on, until such effects are produced as show that its peculiar action is taking place upon the system. Meanwhile it is advised to administer mild purgatives, and if the patient is plethoric, if the pulse rises, or if fixed pain is felt in any part of the abdomen, to employ one or two bleedings. Heister, De Haen, Conradi, and Hufeland have all reported favorably of this mode of treatment, and Cullen advised the use of tobacco smoke and of the tobacco clyster in obstinate *costiveness*. Dr. Bar-

[1] Works (ed. of Syd. Soc.), ii. 269. [2] Dict. de Méd. en 60 vol.
[3] Medical Observations and Inquiries, ii. 307.
[4] Diseases of the Stomach, etc. (Edinburgh, 1828), p. 144.

tram reported the case of a lady affected with aggravated *tympanitis*, who was entirely relieved by smoking tobacco freely.[1] In *strangulated hernia* the relaxing effects of tobacco have been repeatedly invoked with success. Of late years, it is true, its use has been discountenanced, and the operation advised as soon as the taxis, warm bath, and bleeding have failed;[2] but it has not, perhaps, been sufficiently considered that tobacco produces the proper effects of both of the latter remedies with more certainty and with a less expenditure of the patient's strength. Mr. O'Donovan, who speaks highly of the use of this treatment in constipation of the bowels and hernia, and who publishes several striking illustrations of its utility, recommends that the enema, made by infusing from thirty to sixty grains of tobacco in a wineglassful of hot water for twenty minutes, should always be administered by the medical attendant himself, who should not leave his patient until all symptoms of tobacco sickness have ceased, and that brandy or other diffusible stimulant should be at hand for administration in case of need.[3] Cases of the same sort are reported by Ronzier-Joly.[4] Dr. Jackson (of Northumberland) has furnished several examples which illustrate the excellent qualities of this remedy.[5] One mode in which he employed it deserves attention, for cases of obstruction may occur where none of the needful appliances for preparing or administering enema are accessible. Dr. J.'s patient was furnished with a cigar, and directed to swallow the smoke. He soon became nauseated, relaxed, and covered with a cold sweat. The bowel was then easily reduced, and the free use of ammonia soon restored the patient to his ordinary feelings. To give an enema of tobacco smoke, a homely but simple expedient suffices, which was first suggested by Th. Bartholinus.[6] An empty pipe is inverted over one in which tobacco is already burning, a strip of paper is thickly wound around the juncture, and when the stem of the second pipe is inserted into the anus, an attendant, by blowing through the first, drives the smoke into the bowel. Another equally simple expedient was suggested by Gaubius; the nozzle of a pair of bellows is introduced into the rectum, and the smoke drawn into the instrument from a funnel placed over the vessel containing the burning tobacco. But whatever mode is selected for applying this remedy, the proper period for doing so is as nearly as possible after the symptoms of strangulation have appeared, while the patient is still strong, and when the protruded bowel is free from adventitious adhesions. At a more advanced stage he may be unable to bear the amount of sedation requisite for reducing the hernial mass, even should adhesions not already render this impossible.

In *cholera morbus* and *lead colic* the smoke and the infusion, as well as fomentations, of tobacco have been recommended by various

[1] Trans. Coll Phys. of Philad. (1798), i. 197.
[2] South's ed. of Chelius, Am. ed., ii. 290.
[3] Dublin Quart. Journ., Aug. 1858, p. 44.
[4] Bull. de Thérap., liii. 385.
[5] Am. Journ. of Med. Sci., xxv. 302.
[6] BONETI Thesaur. Med. Pract., ii. 555.

authors, but their success is not such as to inspire confidence in so violent a remedy. *Ascarides* have been very successfully treated by tobacco enemata, and even round worms have been expelled after the injection of tobacco smoke, as happened in Mr. Turner's cases alluded to above. In *poisoning* by mushrooms, tobacco is said to be a certain antidote.[1] Their mode of action appears to be, in many instances, to produce congestion of the brain and narcotism; in these, at least, the salutary power of tobacco is explicable. Two cases are recorded by Dr. Emerson in which tobacco appears to have acted as an antidote to arsenic, and some experiments on dogs were made by W. Schultz, which seem to bear the same interpretation; but Dr. Florio, on the other hand, asserts that his trials with rabbits do not furnish any ground for adopting the conclusions of the previous observers.[2]

Dropsy.—Towards the close of the last century the virtues of tobacco as a diuretic were highly extolled by Fowler, who reported a large number of cures of dropsy and dysury through its use.[3] Of dropsy he states that he had treated seventy-nine cases, of which twenty-eight were cures and thirty-two relieved. In his work a great many of the cases are described, but with such scanty details that it is quite impossible to decide how many of them were examples of simple anasarca and serous effusion, and in how many the dropsy was merely symptomatic of some organic affection, and in its nature incurable. Dr. F. employed chiefly the following preparation: ℞.—Tobacco, ℥j; boiling water, Oj. Macerate for an hour in a covered vessel placed in a sandbath; strain off fourteen ounces, and add to them two ounces of alcohol. Of this infusion about forty drops twice a day was the dose for an adult to begin with, but it was rapidly increased until a slight degree of vertigo or nausea was felt after each dose. The quantity was then diminished, so as to prevent these disagreeable symptoms, especially if the discharge of urine was augmented, which seems to have been generally the case. The immediate effect of the medicine is described as a pungent and transient sensation of heat in the throat, which was sometimes followed by a sense of warmth in the stomach, and generally by diuresis, with a slight degree of nausea and giddiness. In large doses it was usually laxative. The effects of the medicine were always most marked in weak, delicate, and irritable constitutions. On the whole, it seems probable that tobacco might with advantage take the place of digitalis in the treatment of many dropsies for which that medicine is now prescribed. The cases of *dysury* in which Fowler derived benefit from tobacco appear to have been those in which the urine was scanty and high colored, and often contained sabulous deposits. In these, by its diuretic properties, tobacco was probably useful, though less so than saline medicines would have been. Later writers have recommended tobacco enemata in cases of retention of urine; and in suppression

[1] SZERLECKI, loc. cit. [2] DIERBACH, op. cit., p. 901.
[3] Med. Reports of the Effects of Tobacco, etc. 2d ed. London, 1788.

of the same excretion the tincture of tobacco, taken internally, has been found efficacious.[1]

The infusion of tobacco has been recommended by Pittschaft for *nocturnal pollutions*, and the medicine in substance by Fischer against involuntary seminal emissions.

Pulmonary Affections.—The palliative influence of tobacco fumes in nervous *asthma*, and even in the paroxysms proper to emphysema, is well known; but unfortunately the habit of smoking dulls their power over these affections. If, however, the smoke is swallowed or drawn into the lungs while yet the attack is slight, its benefits may be enjoyed even by habitual smokers. Dr. Sigmond relates that at the time when lobelia inflata was the subject of extravagant praises in the English journals, there "was not a particle of it in the drug market." The druggists dispensed tincture of tobacco instead, and probably without any abatement of the patients' profit. Subsequently, several instances of the powerful effects of tobacco smoke in this affection were published by Dr. H. Salter.[2] The infusion of tobacco has been employed in *pneumonia*, *hæmoptysis*, *whooping-cough*, etc., but with no results entitling it to special notice. *Asphyxia* produced by drowning and other causes has been treated with singularly happy results by tobacco smoke or infusion, if the narratives relating to the subject are entitled to credit. The practice is alleged to have originated among the aborigines of this country, but it so far acquired the confidence of Europeans that in Paris station-houses along the Seine were furnished with appropriate apparatus for administering this succor to drowned persons. Although the practice seems to have fallen into discredit, it may possibly have been efficacious, conjointly with other means, in cases of insensibility produced by cerebral congestion.

Mode of Administration and Dose.—Tobacco may be given in *substance* in the dose of five or six grains; but it is rarely prescribed in this form. An *infusion* and a *wine* of tobacco are officinal, the former of which may be used as a wash where the skin is unbroken, or administered *per anum*, eight fluidounces at a time; if its appropriate effects do not show themselves in half an hour, the remainder may be given. These doses are as large as some that have produced serious symptoms. The *wine* of tobacco is very seldom used. Its dose is from ten to thirty minims. Fowler's infusion, described above, is probably a better preparation. Tobacco *ointment* may be applied to eruptions, tumid glands, and to bruised parts, with the precautions already mentioned. The fresh plant may be used for several of the medicinal purposes of tobacco, but, from not having yet undergone fermentation, its properties are far less active than those of the prepared leaves.

[1] Mérat and De Lens, op. cit.
[2] Lancet, September, 1858, p. 279.

VERATRUM ALBUM.—White Hellebore.

Description.—Veratrum album is a native of Europe, where it abounds in Switzerland and some adjacent countries. It is a very beautiful plant, and measures from two to four feet in height. It is surrounded near its base with large, broad, plaited, and somewhat hairy leaves, and bears on the summit of its stem large panicles of greenish-white or greenish-yellow flowers. The rhizome is fleshy, cylindrical, and furnished with numerous separate radicles. This is the officinal portion of the plant, and, as found in the shops, is generally denuded of its radicles. It is about the thickness of a man's little finger, blackish and wrinkled without and whitish within, and the radicles, when they exist, are about the size of a crow-quill, and yellowish externally. In its fresh state the root has a strong and nauseous smell, which is nearly lost by drying. The taste, even of the dried root, is at first sweetish, but afterwards is persistently bitter, acrid, and burning. Its virtues depend chiefly upon *veratria*.

Action. *On Animals.*—The white hellebore plant is said to be very injurious, and often fatal to flocks and herds that browse upon the grass where it grows and to domestic fowls that eat its seeds. The older writers describe vomiting and spasms with gastric inflammation as its chief effects upon animals, and they state that in Spain arrows dipped in its juice were formerly used in hunting. The wounded animals perished from the effects of the poison, but their flesh was not rendered unfit for eating.[1]

Gohier made use of a decoction of white hellebore to bathe dogs affected with the mange. They became lethargic, howled piteously, vomited, had a frequent pulse and injected eyes, and appeared to be epilectic or rabid.[2]

Wibmer has given an abstract of the experiments of Wepfer, Courten, Viborg, Schabel and Emmert, Orfila, Hertwich, and others, with this substance upon various animals both large and small. The effects were nearly the same whether it was introduced by the skin, the stomach, the rectum, the bloodvessels, or any other part, and consisted of straining to vomit or actual vomiting, salivation, general debility, a small, feeble, irregular, or rapid pulse, slow and labored respiration, spasms of the abdominal muscles, general tonic or clonic convulsions, tremulousness and a tottering gait, an increased discharge of urine or perspiration, contraction of the pupils, and insensibility.

After death the lungs were usually found congested, and, when the poison had been introduced into the stomach, the mucous membrane of this organ was red.[3]

On Man.—Bergius, Brückmann, Ettmüller, and others, have de-

[1] Murray, Apparat. Med., v. 145.
[2] Mérat et De Lens, Dict., etc., vi. 858.
[3] Wibmer, Wirkung, etc., v. 411.

scribed the operation of the medicine when taken internally. There was often swelling of the tongue and soreness of the mouth, and in all the cases burning heat in the stomach and vomiting were observed, with anxiety, tremor, vertigo, weakness of the limbs, faintness, syncope, aphonia, interrupted respiration, a feeble pulse, convulsions, distortion of the eyes, dilated pupils, blindness, mental derangement, sometimes prolonged insensibility, and cold sweating of the whole body. In not a few instances death resulted, when inflammation of the stomach and congestion of the lungs were found. When the effects were not fatal, there often remained for several days debility, tremulousness, muscular twitching, and a sense of constriction and distress in the præcordial region. Greding, who attempted the treatment of insanity with this medicine, began by administering doses of one grain and gradually increased them to thirty or forty grains a day at a single dose. He was deterred from carrying his experiment further by the severe symptoms which were developed. Besides most of those just described he observed severe pain in the head and back, a sense of tension in the neck and spine, roaring noises in the ears, colic, very frequent purging and vomiting, thirst, copious urination and profuse sweats, chilliness and shivering, coryza, hoarseness, and violent coughing. Powdered hellebore applied to the epigastrium may produce vomiting, and, if the cuticle is broken, the further constitutional effects of the drug may be experienced.

Uses.—It has been doubted whether the white hellebore (ἐλλεβόρος λευκος) of the ancients was identical with veratrum album. Pliny, however, says of the former that it affects the head and acts as an emetic, but black hellebore purges; and he adds that the former is by much the most powerful.[1] Prof. Schroff has examined the historical question very thoroughly, and proves that there is in reality no room for doubt upon the subject. He states that whenever hellebore is mentioned without qualification, in the Hippocratic writings, white hellebore is to be understood, whereas black hellebore is exclusively referred to as a purgative, and always with the descriptive adjective, thus: ἐλλεβόρος μελας.[2] It appears to have been used in the treatment of chronic diseases, rebellious to ordinary remedies, and which it was attempted to cure by making a powerful perturbative impression upon the system. Such were insanity, especially in its melancholic forms, dropsy, chronic diseases of the skin, tetanus, hydrophobia, gout, tic douloureux, coxalgia, quartan ague, chronic coughs, etc. Avicenna refers to convulsions and heaviness of the head as among the poisonous effects of white hellebore. As appears from Dioscorides and other writers, it was always administered in conjunction with diluent or lenitive medicines for the purpose of moderating the harshness of its action.

It gradually fell into disuse, either on account of the accidents occasioned by its imprudent use, or, what is more probable, because new remedies were introduced to supplant it under the dominance

[1] Hist. Nat., xxv. 21. [2] Prager Vierteljahrs., lxiii. 118.

of new medical theories. Yet in dropsy, epilepsy, and insanity it was not entirely abandoned, in spite of the severity of its operation, which was fully recognized; and it was also applied externally for the destruction of *vermin* in men as well as beasts. A strong decoction of this substance has been found speedily to cure *pruritus vulvæ;* possibly by its insecticide virtues.

The irritant properties of the medicine led to its use as an *errhine* when finely powdered and diluted with starch or other inert substance, or with snuff. Under the name of cephalic snuffs such mixtures have been used to relieve the *headache* which attends the onset of *coryza*, by promoting a discharge of the nasal mucus.

Its hostility to the life of the lower animals caused it to be employed in the cure of *itch*, either in a simple ointment or associated with sulphur, ammoniated mercury, sulphuric acid, or nitre; but equally efficacious and less disagreeable remedies have supplanted these.

SABADILLA.—CEVADILLA.

Description.—Veratrum sabadilla is a native of Mexico. Its Spanish name, which is a diminutive of the word *cebada*, barley, is said to have been given it from the resemblance it bears to this plant in its leaves and fruit. The ensuing description, which follows after that of Guibourt, Neligan, and others, answers more closely to *Asagræa officinalis*, Lindley. The root is bulbous, and from it springs an annual stem five or six feet high, garnished with numerous long, linear, grassy leaves, and terminating in a long spike of small white flowers, which are succeeded by seed-pods forming an ear resembling that of barley. The fruit consists of three oblong, delicate capsules, coalescing by the base, and about half an inch in length, in each of which are contained several shining black seeds, about three lines long, hard, inodorous, and of an exceedingly acrid and permanently bitter taste. These are the officinal portion of the plant. Their active properties are derived from the *veratria* which they contain.

Action and Uses.—Murray quotes[1] several authors to show that this substance is capable of destroying dogs and cats, and of occasioning in them vomiting and convulsions.

Two children, aged three and a half and one and a half years respectively, drank of a decoction of white hellebore intended to destroy the vermin upon cattle. The principal symptoms were the following: Violent vomiting of acid and yellow fluid, insensibility, a pale and sunken countenance, a small sharp pulse, heat of head and coolness elsewhere, slight spasmodic movements of the face and limbs, neck somewhat swollen, deglutition impossible, pupils dilated, and eyes projecting, with oscillatory movements of the globe. Both children recovered.[2]

Monardes, who was the first person to furnish an account of its

[1] Op. cit., v. 170. [2] Prager Vierteljahrs., lxxi. 117.

virtues (1572), says that it acts like a cautery upon ulcerated or gangrenous flesh. Until the close of the last century it was almost exclusively employed as an external application, and chiefly for the purpose of destroying vermin in bedding and other furniture, and also the lice infesting the persons of soldiers, sailors, paupers, and a certain order of friars. From the last-named usage it was popularly known in France as the *Capuchin's powder*. Cases were not wanting in which its application to the sore head produced alarming symptoms, and even death. Its tincture has been found efficient as a remedy for the *itch* by M. Bourbousson. Lhuillier declares that, in the course of a large experience with the remedy during fifteen years, he never once failed to effect a cure by means of frictions made with powdered cevadilla mixed with sweet oil and brandy immediately after the patient had taken a prolonged warm bath.[1]

As a *vermifuge* for tænia, this medicine has been vaunted by Schmucker and Herz, and for ascarides of the rectum by Hufeland. By the former two physicians it was also alleged to be efficacious in *amenorrhœa*, *chlorosis*, *mania*, *melancholy*, *epilepsy*, and *chorea*,[2] and Foulhioux claims to have cured *hydrophobia* by its means.[3]

The dose of the powdered seeds is stated at thirty grains; it should be followed by barley-water sweetened with honey, and repeated daily, but in smaller doses. Thirty grains infused in two ounces of boiling water may be given at a dose.

Veratria.

Preparation.—To a distillate and decoction of the seeds of cevadilla in alcohol sulphuric acid is added, which forms a sulphate of veratria in solution. On the addition of magnesia, the veratria is precipitated in an impure state, and is then collected and redissolved in alcohol. By evaporation of the latter, the veratria is partially purified, and still further by boiling in water acidulated with sulphuric acid and containing animal charcoal, and then straining the solution. On the addition of ammonia, the veratria is precipitated and is then washed with cold water and dried. It is a grayish-white amorphous powder which fuses at a moderate heat, becomes red on the addition of sulphuric, and yellow with nitric, acid. It restores the blue color of litmus paper reddened by acetic acid. It is very slightly soluble in water, but is perfectly so in alcohol.

History.—Veratria was discovered by Meissner in the seeds of veratrum sabadilla in 1818, and in the following year it was also extracted from the same source and from the rhizome of V. album by Pelletier and Caventou. In 1821 it was first employed in physiological experiments by Magendie and Andral, and soon afterwards by the former in the treatment of disease. In 1826 Bardsley used it in rheumatism and dropsy, and more general attention to it as a remedy for neuralgia was excited by Turnbull's essay in 1834.

[1] Abeille Méd., ii. 220.
[2] RICHTER, Ausfür. Arzneim., ii. 226.
[3] Revue Méd., lxxxiii. 381.

Action. *On Animals.*—The original experiments of Magendie and Andral, which, however, were not made with pure veratria, led them to conclude that this substance is a powerful local irritant; that, however introduced into the economy, it occasions gastro-intestinal irritation; and that, in large doses, it gives rise to tetanus.[1] More complete and accurate experiments have since been performed. Among them the most valuable are those of Esche,[2] which were performed on dogs, cats, rabbits, and birds, and of which the following is a summary: A few minutes after the administration of veratria the animals manifested anxiety and restlessness, saliva flowed from the mouth, the action of the heart became irregular, slow, and intermittent, and the respiration deep and labored; there was violent retching or vomiting, a copious discharge of liquid with mucus and even blood from the bowels, with spasmodic retraction of the abdominal walls. The respiration gradually became slower and more difficult; the animal appeared by its restlessness to be in great distress, and its eyes were dull and prominent. The voluntary muscles were evidently feeble and unable to support the body, and spasms affected the pharynx, the muscles of the face, and the lower limbs. The functions of the brain were wholly undisturbed. After smaller doses had occasioned vomiting and purging, and transient convulsive movements, with loss of muscular power, and a slow pulse, the animal gradually recovered, but the last symptom, with general debility and want of appetite, remained for some time longer. Very large doses affected the whole nervous system with loss of power and tone; the respiration and circulation gradually became extinct, the convulsive movements passed into tetanus, and the animal died. On dissection, the only changes found were those which attend death by asphyxia; the lungs, heart, and liver were gorged with blood; the tongue, throat, and gullet were pale; the stomach sometimes contracted, but free from all traces of inflammation; and the bowels were also contracted and somewhat reddened. In the brain nothing abnormal was discovered.

From his experiments Esche drew the following among other less important conclusions: 1. The more directly veratria enters the blood, the more rapidly are its effects developed. 2. It is not in a high degree a local irritant. 3. Moderate doses act by producing vomiting, diarrhœa, increased secretion of bile, a slow pulse, impeded respiration, diminished animal temperature, impaired common sensibility, and an altered condition of the blood. 4. Large doses, in addition, occasion debility, then spasm, and finally tetanus of the voluntary muscles. 5. The functions of the brain are undisturbed. 6. It differs from the various vegetable products from which it is extracted by the constancy, rapidity, and extent of its operation, and in its not producing inflammation of the stomach and bowels. Van Praag's experiments led him to similar conclusions; but he drew attention to the fact that the primary impres-

[1] ORFILA, Toxicologie, 5ème éd., ii. 460.
[2] De Veratriæ Effectibus, 1836; VIRCHOW's Archiv, vii. 260.

sion of veratria on the nervous system, and through it upon the circulatory and muscular system, is that of a stimulant, while its ultimate effect is to produce spinal paralysis.[1] Analogous results were obtained by Faivre and Leblanc.[2]

The experiments of Kölliker appear to show that veratria exerts through the blood a directly paralyzing action on the muscles, which thereby lose their irritability, and become tetanic. This action was demonstrated in a frog by tying the artery of a hinder extremity, and severing all connection of the limb with the trunk except through the ischiatic nerve, and then administering veratria. The usual succession of symptoms was presented in all of the body except the disconnected leg, whose muscles retained their irritability after this property had been lost in every other part of the muscular system. Again, the ischiatic nerve having been divided in another frog, veratria was administered, and the muscles of the whole body became tetanic.[3] Thus, positively, as well as negatively, it was proved that the poison exerts its power directly upon the muscles, or upon the nerves distributed to them, and not necessarily through the intervention of the spinal centre.[4]

On Man.—Veratria has an acrid bitter taste, and even the least portion of it, placed upon the tongue, produces a peculiar and persistent numbness and tingling. The minutest quantity of it, introduced into the nostrils, and even the casual approach of a vial containing it to the nose, occasions protracted irritation and sneezing.

Applied in an ointment to the sound skin, it occasions slight redness and a prickling sensation; or, if the integument be tender, as around the umbilicus, the pain may be severe, and is compared by Van Praag to that which might be produced by hot needles thrust into the skin. After a few minutes this pain subsides, and is followed by a sense of coldness in the part. If the frictions are repeated, according to Turnbull, particularly upon the face, slight twitchings of the muscles are sometimes observed, and more rarely formication extends from the point of application over the whole body. In some cases, where an ointment composed of twenty grains of veratria to an ounce of lard was rubbed into the skin, severe pain was experienced, and an eczematous eruption followed. When used by Ebers[5] as an endermic application to the epigastrium, it excited acute pain in the superficial nerves, a dragging pain seated in the spine, muscular twitchings compared to slight electric shocks, and, in addition the symptoms usual after the internal administration of the medicine.

The effects of veratria, taken internally, are described in nearly the same terms by those who have employed it, including Turnbull, Forcke, Roëll, Ébel, Ebers, Gebhard, and others. In medicinal

[1] VIRCHOW's Archiv, vii. 286.
[2] Archives Gén., 5ème sér., v. 258.
[3] VIRCHOW's Archiv, x. 257.
[4] For a more minute analysis of the actions of veratria on the lower animals, compare BEZOLD and HIRT, Untersuch. aus dem phys. Laborator. in Wurzburg, 1867: PREVOST, Annuaire de Thérap., xxviii., 27; NUNNELEY, Practitioner, iii. 348.
[5] DIERBACH, Die Neuste Entdeck., ii. 488.

doses, the sensible phenomena consist of a sense of tingling, first felt in the fingers and toes, but diffusing itself over the whole body, and followed by a sense of numbness and coolness in the same parts, and occasionally by a diminished frequency of the pulse. Somewhat larger doses occasion twitching of the muscles, and this symptom is most striking in muscles which are partially paralyzed. If the usual limit of medicinal doses is exceeded, and $\frac{1}{10}$ gr., for instance, is administered, nausea, distress, faintness, loss of appetite, and perhaps some looseness of the bowels may be observed; and if this dose is repeated, or exceeded, nervous symptoms are developed, such as tension and pain in the spinal nerves and along the spinal column, jerking of the muscles, great anxiety, dyspnœa, nausea, and vomiting. The proper effects of fatal poisoning by veratria in man have not been described. Dr. Taylor refers to a case in which it is said that a lady who had taken $\frac{1}{16}$ gr. of this substance "was found insensible, the surface cold, the pulse failing, and there was every symptom of approaching dissolution."[1] The following case is reported by Mr. C. Paget Blake. A lady suffering from neuralgia of the face, swallowed a portion of a liniment, which portion, besides glycerine, chloric ether, and opium liniment, contained about three grains of veratria. She was affected with giddiness, nausea, thirst, relaxation of the bowels, with tenesmus, and a sense of constriction in the abdomen; felt fatigued, weak, and faint; her tongue was swollen, the mouth and throat sore, the pupils contracted, the breathing hurried, the pulse quick and very small, and the action of the heart very feeble. Swallowing was rendered difficult by a sense of constriction in the fauces. There were frequent calls to urinate, and the bowels were moved several times. The most annoying symptom was a continual tingling and itching over the whole skin. The itching subsided after two or three days; but the tingling continued for at least two months, as well as a spasmodic movement of the lower jaw which would frequently shut suddenly with a loud snap when the lady was eating, talking, or laughing. In this case a fatal issue was probably prevented by the medicines, associated with the veratria, and by the prompt administration of an emetic of sulphate of zinc.[2]

Remedial Employment. *Neuralgia.*—Bardsley was the first to employ veratria in *sciatica*, an affection which is usually regarded as neuralgic, but which is much more frequently of an inflammatory nature—*i. e.*, produced by cold, and consisting of a thickening of the fibrous investment of the nerve, as it passes through the ischiatic notch. He reported six cases of this affection, two of which were cured and four relieved by the administration of a quarter to half a grain of the medicine three times a day.[3] In 1833 Turnbull claimed to have perfectly cured twelve out of thirteen cases of different forms of neuralgia by the external use of veratria ointment;[4] but the evident exaggeration of his statements only

[1] On Poisons, 2d Am. ed., p. 510.
[2] St. George's Hosp. Rep., v. 69.
[3] Hospital Facts and Obs., 1830, p. 115.
[4] Brit. and For. Rev., ii. 499.

served to discredit the remedy with judicious men. Dr. James Johnson furnished, however, a partial confirmation of them, by reporting that it had, in his hands, afforded relief in three cases of facial and two of crural neuralgia.[1] Similar effects were reported by Brück, Ebers, aud Roëll, who maintained that the remedy is only efficacious in functional neuralgia, and by Cunier,[2] who cured forty-one out of a hundred and twelve cases of the same affection. Gebhard's experience somewhat resembled that of Roëll, for he had found the frictions useful when the pain was diffused in the terminal branches, rather than when it was confined to the trunk of the nerve;[3] and Lafargue regarded its effects, when inoculated, as extraordinary.[4] Like the physicians already cited, Forcke and Reil[5] found the remedy very efficient, both in frictions and when introduced by punctures into the skin, provided the disease were wholly functional. The latter regarded veratria and aconitia as the best substitutes for one another. It is somewhat remarkable that, in opposition to this positive and authoritative testimony, we have Dr. Henry Hunt declaring that he "never succeeded in giving even temporary ease with veratria," although he used it in the proportion of ten grains of the alkaloid to half an ounce of ointment.[6] We believe that general experience accords decided virtues to the medicine as a local remedy, although it is probably inferior to aconitia, employed for the same purpose and in the same manner.

Rheumatism.—Of nineteen cases of *chronic rheumatism* which Bardsley treated by the internal use of veratria, three only are stated to have been cured, nine were relieved, and seven were unimproved. In so obstinate a disease, this degree of success is not without merit. Turnbull reports more cases of cure, but does not allude to those of failure. In *acute rheumatism* the medicine has been more successful. Among others, Piedagnel employed it alone in the articular form of this disease, with decided advantage, in doses varying from $\frac{1}{16}$ to $\frac{1}{2}$ gr.,[7] and gradually increasing the dose until the medicine was no longer tolerated. Trousseau assures us that during two years he made use of this method with generally satisfactory results. He describes the most usual effect of it, as a reduction of the fever and pain in the course of a few days, so that in a patient of unimpaired constitution it frequently triumphed over an acute attack of the disease in the space of a week. Not, however, that it always accomplished a cure; for sometimes, after having reduced the febrile symptoms to a subacute type, they continued their usual course for the space of two or three weeks. Its curative power, therefore, does not exceed that of sulphate of quinia and nitrate of potassa. The former of these two medicines also appears to be preferable when the patient is feeble, anæmic, or exhausted by other diseases. Aran reports that of eight cases of

[1] Med.-Chir. Rev., xxi. 163.
[2] Bull. de Thérap., xiv. 8; xv. 329.
[3] Ibid., xxxiii. 255.
[4] Ibid., p. 353.
[5] Mat. med. der rein chem. Pflanzenstoffe, p. 308.
[6] On the Nature, etc., of Tic Douloureux (London, 1844), p. 184.
[7] Bull. de Thér., xliii. 141.

acute articular rheumatism, the cure by veratria was very rapid in four, that the treatment was ineffectual in two cases, and that in two others it had to be abandoned on account of the intolerance of its effects, by the patients. The duration of the disease, after the commencement of the treatment, was eight days, on an average, in the cases which were cured. On the whole, as M. Aran remarks, this result is far from being a very favorable one, particularly when it is considered how much distress the remedy occasions in nausea, vomiting, epigastric pains, prostration, etc. But this writer is of opinion that when articular rheumatism is complicated with pericarditis, the danger of the attack is sensibly lessened by the sedative operation of veratria.[1]

Pneumonia.—In this disease M. Aran, who was induced by Dr. Norwood's publications concerning veratrum viride to experiment with the medicine under notice, observed that when it was given in such doses as developed its irritant and sedative effects, a rapid and decided amelioration took place in several of the symptoms, and particularly in the dyspnœa, cough, and expectoration, and, what is peculiarly important, it caused the physical signs of hepatization to disappear with unusual rapidity.[2] But the number of his cases, six in all, were insufficient for determining the precise value of the remedy. Fournier treated forty-one cases of the disease according to the same method, with such success, that he pronounces it the most certain means of promoting resolution;[3] but Ghiglia is of opinion that it is seldom efficient, and ought not to be administered unless depletion has been premised.[4]

Veratria has occasionally been used in acute *pleurisy* and *pericarditis*, in the former without notable advantage, but in the latter with marked alleviation of the præcordial distress. By producing a similar effect in some cases of *valvular disease of the heart*, it has been found a useful palliative; and in some instances of *dropsy* resulting from suppressed discharges, or from organic disease, it has seemed to promote the absorption and discharge of the effusion, probably by its sedative influence on the heart. But in all such cases it must occupy a very inferior position to digitalis. It has been used for these affections both internally and externally. In the latter mode, also, it is stated to have cured various chronic inflammations, such as *enlarged glands*, and scrofulous *swelling of the joints*; but here its value is probably very slight. It is unnecessary to add anything of its alleged occasional efficacy in *whooping-cough*, *chorea*, *hysteria*, and *functional paralysis* of the facial and other superficial nerves. For all of these affections the materia medica contains more certain and less disagreeable remedies for internal administration. In the last-mentioned disease frictions with veratria ointment are deserving of trial.

Administration.—On account of its acrid taste, veratria is always administered *internally* in pilular form, and in doses varying

[1] Bull. de Thérap., xlv. 395.
[2] Ibid., xlv. 61.
[3] L'Union Méd., quoted by REIL, loc. cit.
[4] Bull. de Thérap., lvi. 109.

from one-fortieth to one-fourth of a grain. The dose should be gradually or rapidly increased from the minimum mentioned, according to the acuteness and the nature of the disease, until nausea or depression of the pulse announces that its constitutional influence is established.

For *external* use it may be employed in solution, or mixed with lard or oil. From one to four grains of veratria in a fluidrachm of glycerin or alcohol, or four grains of the alkaloid to sixty grains of lard, may be prescribed. The latter preparation causes decided pricking and stinging of the skin. (*Reil.*) The officinal ointment of veratria (UNGUENTUM VERATRIÆ) contains twenty grains of the alkaloid to a troyounce of lard. For *endermic* use from one-eighth to one-half a grain may be prescribed, mixed with starch. For hypodermic *inoculation* one-sixth of a grain of veratria, or of its muriate, may be employed at a single operation, which may be repeated twice a day; but the pain caused by this method is a sufficient reason for discarding it.

Class XI.

EVACUANTS.

Evacuants are medicines which produce discharges from certain organs. The greater number of them are included in the Class of Eliminants admitted by some modern writers, and particularly treated of by Mr. Headland.[1] The latter term is, we think less eligible than the former; for while it is certain that these medicines do produce evacuations from the various emunctories of the economy, it is not certain, and it by no means follows that they eliminate any material cause or element of disease.

The use of evacuants, which is coeval with the earliest history of our art, was undoubtedly suggested by the operation of nature in the cure of many diseases. It is of daily observation that convalescence is ushered in by discharges, especially from the skin, the bowels, and kidneys, and when it was discovered that certain plants and other natural agents excite or promote such discharges, they were instinctively employed to produce similar effects at the will of the physician. As it was a part of the existing pathological doctrines that the symptoms of disease are the result of a struggle on the part of the system to expel some peccant humor from the body, evacuants were presumed to promote its expulsion, and in that manner contribute to the restoration of health.

The material causes of disease were not then demonstrated, nor, indeed, have the minutest investigations of modern chemistry and physiology succeeded in revealing them. But in following up medicinal substances in their hypothetical chase after the morbid principles they have been thought adapted to destroy, it has been found that those belonging to the present class are far from exerting their power upon all the excretory organs indifferently. The same laws which preside over the composition and decomposition of the organic elements of the body, prevail also here. As the different constituents of the food are appropriated, each after its kind, by the living bone, muscle, gland, or membrane; and as the unassimilable portions of the food are rejected, this by the skin, that by the bowels, and that by the kidneys, according to its peculiar constitution, different medicines are in like manner discharged by the several organs named, and by others, either exclusively or principally.

[1] On the Action of Medicines.

Solid nutriment, whether wholly or only in part unassimilable, is ultimately evacuated from the bowels; fatty substances, after having been taken into the circulation in the form of an emulsion, are secreted by the liver; liquids and saline matters pass off by the skin and kidneys; and among medicines some are discharged with the secretions of the bowels, some with those of the skin, the kidneys, or the bronchial mucous membrane. In thus passing from the body, as might indeed be anticipated, they stimulate to unusual activity the organs through which they are discharged, and increase their normal secretion so long as the stimulation is restrained within certain limits. But once this bound exceeded, the secretion, instead of being promoted, is impeded and diminished, to such a degree, it may be, as to become a cause of disease and death. Thus cantharides, copaiba, or oil of turpentine, in appropriate doses, may augment the flow of urine, but in excess may arrest it altogether by occasioning congestion or inflammation of the kidneys. This proposition is not less applicable to those evacuants which operate both by absorption into the blood, and by their immediate and direct application to the organs they are adapted to stimulate, as, for example, certain emetics and cathartics. Their evacuant operation may depend, in a great measure, upon the reflex action excited by their presence as irritants in the stomach or bowels. Again, emmenagogues become evacuânts in quite a different manner from those agents which augment secretion by directly stimulating a gland; some of them, as ergot and borax, influence the distended uterus chiefly, and others act by contiguous sympathy, or by a continuous irritation propagated from neighboring organs, as from the rectum in the case of aloes, and from the bladder in that of cantharides.

Allusion has been made above to the theory which was anciently invoked to explain the curative operation of evacuant medicines, and according to which they expelled from the system a material morbid principle upon which all the phenomena of disease were supposed to depend. But to any one who will carefully study the Hippocratic writings upon this subject it must be evident that no practical precept was more frequently enjoined or more profusely illustrated than the obligation to avoid any active interference with the process of coction, which was regarded as an essential preliminary to the due discharge of the morbid humor. The Greek physicians did not, as some of the present day propose to do, substitute the forced evacuation of a secretion for its natural flow. For them this was an operation to be respected; to be promoted and encouraged, indeed, but only when the efforts of nature were clearly tending to produce it. The ancient doctrine, therefore, cannot be invoked in support of the modern theory, or of the practice deduced from it, and which consists in the use of evacuant medicines without regard to the stage of the disease, or its natural tendency to a critical discharge. In other words, the preparation of the system for this evacuation, which was an essential part of the Hippocratic method, is now entirely overlooked, or rejected as unnecessary.

The ancient practice truly ministered to nature, the modern is a rude, and what might well be called an impertinent interference with the natural processes of cure when they tend to issue in a critical evacuation. But if we take a general survey of the mode in which health is restored after sickness, we shall find that it is rather by supporting and invigorating the functions of the economy, so as to enable it to resist the exhausting or oppressive influence of the morbid process, than by any evacuant operation whatever. To cite a striking illustration of this view, which has been suggested by Dr. C. Handfield Jones, when a narcotic poison or the virus of a venomous serpent, for example, has been introduced into the system, no attempt is thought of directly to eliminate it, but stimulants are employed to sustain the powers of life during its operation, until the changes in the fluids, etc., which it tends to produce have come to an end, or until it is cast forth from the economy.[1] This remark is quite as applicable to diseases which arise spontaneously but whose active cause is acknowledged to be either a specific virus producing certain changes in the blood which have been hypothetically illustrated by the analogy of fermentation, or which, as Dr. Jones suggests, are rather morbid states of the blood itself, depending upon catalytic processes. The latter was precisely the doctrine of the medical world in the time of Huxham, when it was customary to speak of putrid fevers and putrefactive processes, a doctrine to which the success of the sustaining and stimulant treatment lent the most unequivocal support. All of the continued, including the eruptive, fevers belong to this category, some in a greater and some in a less degree, varying with the prevalent medical constitution. If occasionally, as in the case of typhoid fever, an evacuant treatment has been judged the most efficient, it has been so under the influence of a popular medical theory, or in comparison with other methods, such as depletion, which had more disasters to lament than triumphs to boast of.

Or if we inquire what method has been most successful in treating malarious disorders, in which, if anywhere, an eliminant treatment should have been successful, since their cause can hardly be denied to be a material poison, we shall still find that medicines such as cinchona and arsenic, which promote no sensible discharge whatever, constitute their surest and safest remedies. The history of syphilis presents another striking illustration of the doctrine here set forth. At one time it was believed that a venereal virus pervaded the system, which it required the full and prolonged sialagogue operation of mercury to eliminate; and the profuse and destructive salivations induced as a consequence of that belief are now a matter of history, and of little honor to the medical generations that practised them. Experience has proved, beyond all cavil, that mercury is most efficient in this disorder precisely when its eliminant effects are least decided.

[1] Brit. Med. Journ., BRAITHWAITE's Retrospect (Am. ed.), xxxviii. 269.

If we turn to diseases of the skin, which are often, and sometimes probably with justice, regarded as depending upon and denoting a constitutional cachexia, we are still met by the fact that the most efficient means which can be employed for their cure consist of arsenical and other remedies, which, when duly administered, are very far from promoting the secretions, or reducing the tone or vigor of the system. And although it might appear as if the great relief sometimes afforded by saline diuretics in the acute forms of rheumatism gave support to the opinion that they promote the discharge of a material morbid element, confidence in the doctrine must be greatly shaken when it is recollected that purgatives, of whatever sort, produce no such result, and when it is further remembered that these medicines do not so much eliminate any morbid element, as that they neutralize it within the system.

Believing, then, that as eliminators of specific morbid principles medicines of the class about to be examined have no well-founded claim to confidence, we are compelled to fall back upon their more evident and intelligible actions to explain their great value as curative agents. These will be more profitably considered in connection with the several classes into which evacuants are divided according to the organs upon which they specifically exert their influence. As their general title implies, they are employed to remove from the economy certain matters which interfere with health. These may be mechanical causes of discomfort or disease, and may be expelled from the alimentary canal by emetics or cathartics; they may consist of a positive or relative excess of the circulating fluid, and the before-mentioned agents, with diaphoretics and diuretics, are capable of rapidly reducing the turgor of the blood-vessels; they may arise from an imperfect action of secreting organs, whether secreting membranes or independent glands, whereby the materials for secretion are retained in the blood, and the functions which depend on the just amount of the latter are impaired; but evacuants restore the activity of the glandular organs, and relieve the blood of its excessive proportion of excretory elements. Some among the evacuants are chiefly local in their action, as certain purgatives and anthelmintics; but others, besides producing a general sedative effect through their depletory operation, act directly as sedatives upon the nervous system, and tend to prolong the influence of their more local irritant and revulsive action. Such, for example, are tartar emetic, colchicum, black hellebore, and nitrate of potassa.

It will be found that not a few of the particular medicines classed as evacuants become such only when administered in a certain dose, or in a certain condition of the organs to which they are addressed. So purgatives are habitually employed to cure diarrhœa, not merely by removing irritant causes from the bowels, but by a substitutive action arresting or diminishing the alvine secretions. The same is true of expectorants, of which a particular group has received the name of stimulant; and, in fact, it is also more or less

true that nearly every class of evacuants might be conveniently divided into two sections, the one containing stimulant and the other sedative medicines.

EPISPASTICS. Vid. *Irritants*.

ERRHINES.

ERRHINES are medicines which promote a discharge of fluids from the Schneiderian membrane. Those which provoke sneezing were formerly called sternutatories, or ptarmica. They were employed both as substitutive irritants and as revulsives; as the former, in acute and chronic coryza, and both when it was simple and when it assumed the characters of ozæna; and as the latter, in various affections of the eyes, and even in amaurosis; in some cases, also, of deafness, probably depending upon obstruction of the Eustachian tube; and in several affections involving disorder of the brain, such as epilepsy and paralysis. It was, however, chiefly for the relief of headache, and a tendency to fulness of the head, that these agents were prescribed, and the popular use of volatile aromatic stimulants, in the form of smelling salts, at the present day, affords sufficient evidençe of their utility. Those among them which are apt to excite violent and prolonged sneezing, were directed to be used with caution, lest they should occasion too severe a shock to the brain or to the abdominal organs.[1]

ASARUM EUROPÆUM.—ASARABACCA.

Description.—This agent, which is not officinal, is the product of a native perennial, herbaceous plant of Europe, growing between 37° and 60° north latitude, in woods and shady places. All parts of the plant are acrid. The leaves are nearly inodorous, with a slightly aromatic, bitter, acrid, and nauseous taste. The powder made from them is of a yellowish-green color. The root varies from about the thickness of straw to that of a goose-quill, is jointed, quadrangular, and furnished with radicles, of a grayish-brown color, externally, and whitish within. When fresh, it has an aromatic odor, resembling that of valerian, and readily excites sneezing. Its taste is acrid, bitter, and nauseous.[2] When long

[1] The reader curious to learn more of this subject should consult HOFFMANN's "Dissertatio de Usu et Abusu Pulverum Sternutatorium," Op. Omn. suppl., i. 701.

[2] SACHS and DULK, Handwörterbuch, i. 590.

kept, both root and leaves lose their acrid qualities, and become altogether inert.

Uses.—It was formerly used as an emetic and purgative, for the former of which purposes it was recommended by Matthiolus and Linnæus. It had also some repute as a diuretic, and, like other irritants, was employed with criminal intent as an emmenagogue.[1] A case of death from its use to produce abortion is recorded.[2] In Russia an infusion of the root is said to be used to counteract the craving of drunkards for alcoholic drinks.

Its qualities as an errhine, however, gave it greater repute. When two or three grains of the powdered root are snuffed into the nostrils, no immediate effect is produced; but after a time a copious discharge of mucus, and even of blood, takes place. In this manner it has proved useful in cases of severe chronic *headache*, especially when the pain originated in inflammation of the frontal sinuses; of chronic *inflammation of the eyes*, *paralytic affections* of the mouth and tongue, in *toothache*, etc.

Administration.—As an *emetic* the dose is variously stated by authors as between twenty and sixty grains of the powdered leaves or root. As an *errhine* one or two grains of the root, or twice that quantity of the leaves, may be snuffed into the nostrils. It may also be mixed with ordinary snuff.

HELENIUM AUTUMNALE.—Sneezewort.

This is a perennial herb indigenous to the United States, in all parts of which it grows abundantly in low and moist situations. The whole plant is intensely bitter, and somewhat acrid. When powdered and snuffed, it produces a profuse discharge of mucus, and violent sneezing. Every part of the plant is active, but the central disk florets are the most powerful.

Other errhines might be here described, such as *ammonia*, *turpeth mineral*, *tobacco*, *green* and *white hellebore*, and nearly all of the stimulant plants belonging to the natural families of *Labiatæ* and *Euphorbiaceæ*. But the more important of these will be found treated of elsewhere.

SIALAGOGUES.

Hydrargyrum.	Vid. *Alteratives.*
Mezereum, Pyrethrum.	" *Irritants.*
Tabacum.	" *Nervous Sedatives.*
Armoracia.	" *Diuretics.*
Zingiber.	" *Aromatic Stimulants.*

[1] Murray, Apparat. Med., i. 517.

[2] Casper's Vierteljahrs., ii. 54.

EMETICS.

Emetics, or medicines given to produce vomiting, are among the most ancient and the most universally and frequently employed of all remedial agents. The indication for their use which is most emphatically mentioned by Hippocrates is that which must originally have led to their administration in disease, a sense of oppression at the stomach, with nausea. Celsus makes use of similar terms; but Galen, in his desire of being able to assign a scientific reason for every morbid phenomenon and every practical precept, taught that they are useful because they evacuate the morbid humors which clog the stomach and its ancillary organs. In this, as in other doctrinal subjects, he was followed by the Arabian and the Salernian schools. The introduction of chemistry into medicine was signalized by the vogue of antimony, which was first extolled by Basil Valentine, and afterwards by Paracelsus; and the importation of ipecacuanha towards the close of the seventeenth century only tended to enhance the importance of emetic medicines. Indeed, it was not until within the last century that any serious or widely-spread doubts were entertained concerning their efficacy. On the one hand, according to the Brunonian system, all diseases depend upon debility and require a stimulant treatment; and on the other, according to the Broussaian doctrine, all are of an inflammatory nature, have their chief seat in the stomach, and must be appeased by diluents and depletory agents. The two agreed in condemning the use of emetics, which the former regarded as exhausting, and the latter as incendiary. Thus, for more than half a century, two equally false doctrines conspired to set at naught the experience of ages, and almost entirely to banish emetics from the practice of medicine. Since the extinction of the schools which propagated these inconsistent dogmas the medical profession has, unconsciously, perhaps, submitted to the still more degrading influence of the fanatical and knavish system of Hahnemann, and been prone to abandon disease to its natural tendencies, even in cases the course and issue of which are often determined by an early and vigorous treatment.

At the commencement of every disease, whether idiopathic or symptomatic, its material elements are mobile, and may be readily dispersed by a prompt and energetic perturbation. Like the particles of a saline substance in solution, if allowed to repose, they speedily crystallize in a solid and permanent form, when a little agitation of the liquid would effectually have prevented this result.

In almost all acute internal diseases, vomiting is one of the earliest and most striking phenomena, and one that frequently characterizes the subsequent course of the attack. Considering the relief that it often affords, we cannot be surprised that it should, as just stated, have always been regarded as one of the most important indications

for the guidance of the physician, and it cannot be doubted that the emetic treatment derived from it will again acquire the credit which it once of right possessed.

Purgation, which resembles emesis as an evacuant and derivative agent, is widely different from it, in the organs which it directly affects, and more particularly so in the perturbative operation which renders the latter so potent a remedy. Still less does evacuation of blood by venesection, or of urine, perspiration, or bronchial mucus by the agents which especially provoke their discharge, compare in its effects with the profound and powerful, although temporary, convulsion of the whole economy by the act of vomiting which must tend in an extraordinary manner to break up the morbid habit into which it was about to fall, or had already settled.

In order to appreciate more fully the phenomena of emesis, and the action of the causes which produce it, it is necessary to consider the nervous sympathies, or rather the nervous physical relations, of the stomach. It is supplied with branches of the vagi nerves, whose chief office appears to be to control the active movements of the muscular coat of the organ; for its peristaltic action continues even after the section of those nerves. It is also abundantly furnished with branches of the great solar plexus and other neighboring ganglia of the sympathetic nerve, which are most numerous in the pyloric half of the organ, while those of the par vagum chiefly supply its cardiac extremity. The sympathetic nerve appears to be endowed with the function of causing rhythmical movements in certain hollow viscera, by which term may be designated the heart and bloodvessels, the bronchial tubes, the urinary passages, the uterus and its appendages, the pharynx and œsophagus, and the gastro-intestinal canal. It is quite intelligible, therefore, that a strong impression made upon the stomach, the nerves of which appear, even anatomically, to hold a central position in the ganglionic system, should be reflected upon many other parts of the economy, and upon those particularly which are concerned in the processes of organic life, and that it should in an especial manner influence the action of the arteries and the secretions which immediately depend upon them.[1]

This statement, general as it is, of the sympathies of the stomach, indicates the modes in which that organ may be influenced by impressions made upon distant parts, and, reciprocally, how its own state may affect them, and consequently how a strong and sudden commotion in it may become the means of essentially changing their condition and mode of action. As a hollow muscular organ, open at both ends, it is capable of propelling its contents in either direction. In a normal state it carries them forward to the pylorus; but under the action of irritants, that is to say, of substances intrinsically unassimilable and productive of irritation,

[1] Consult an article by HORATIO C. WOOD, Jr., M.D., "On the Influence of Section of the Cervical Pneumogastrics upon the Action of Emetics and Cathartics," Am. Journ. of the Med. Sci., July, 1870, p. 75.

it sets up a retrograde action which tends to reject and expel them through the œsophagus. Such are the mineral emetics, sulphate of zinc, and sulphate of copper, and other substances which, although assimilable, yet in an undue quantity produce an analogous action of the stomach, and stimulate it by their bulk as well as by their acrimony. Such agents are the domestic emetics, salt and mustard. It is well known, also, that mere repletion of the stomach with assimilable food is sufficient to excite vomiting. These effects are evidences of a wise provision against the dangers to which the stomach, one of the essential supports of life, is peculiarly exposed. Its degree of susceptibility to the irritant impression of ingesta, and especially of excessive quantities of food, varies in different persons even in health, and is generally most developed in those of a delicate organization, and in females more than in men. It is also awakened with great facility in children. In all of these cases, the stimulus which issues in the act of vomiting, is applied directly to the stomach itself. But in others, a remote irritating or exciting cause may produce the same effect. Tartar emetic, for example, which is the most powerful agent of its class when applied directly to the stomach, is equally certain in its emetic effects, whether it is thrown into the rectum or injected into a vein. From this fact we can only infer that the medicine operates upon the nervous centres which control the movements of the parts concerned in the act of vomiting, and it is more probable that it does so than that it irritates the terminal extremities of the nerves themselves. The *central influences* which occasion vomiting may be illustrated by the effect of the movements of a ship, a swing, a carriage, or even a rocking chair; of blows upon the head; of inflammation and other affections of the brain; of ideas of disgusting objects or sensations; and of certain emotions and passions, as fear, and the depression which follows violent anger. Under this head it is also proper to rank those singular cases in which the power exists of emptying the stomach at will, by an act similar to that which is habitual with ruminating animals. We are acquainted with a family in which the father and a daughter both possess the faculty of relieving themselves of food which oppresses or annoys them. Vomiting may also be the consequence of *reflected irritation*, as when it is excited by tickling the fauces, by a calculus in the gall-ducts or ureters, by the presence of the fœtus *in utero*, by the contraction of the uterus in parturition, etc.

The phenomena of vomiting, particularly as excited by emetic substances, require a brief description, which, it may be proper to state, has reference rather to nauseating, than to so-called mechanical, emetics. The primary symptom is usually an uneasiness at the epigastrium, with general and undefinable discomfort, an anxious expression and paleness of the face, and perhaps a sense of chilliness with slight shuddering. The mouth is filled with saliva, and an irritation in the pharynx seems to respond to a laboring movement in the region of the stomach. The saliva is swallowed, and often with it mouthfuls of air, as if to repress the rising in the throat.

Very soon spasmodic contractions of the abdominal muscles, diaphragm, and stomach take place, and with them the sense of nausea increases, and the general aspect of the patient is more and more that of prostration. The body is usually bent forwards, the head outstretched, and the straining efforts of the abdominal muscles are assisted by the hands clutching the knees, an assistant, or some piece of furniture within reach. The breath is held, and, often with a violent effort, the contents of the stomach are projected through the mouth and nostrils, and generally in successive gushes. After the food, a liquid is vomited which is usually sour, and if the retching continue, bile is thrown up under the double action of an anti-peristaltic movement of the intestine and the repeated acts of compression to which the gall-bladder and duodenum are subjected. During this stage of the operation, the pale and sunken aspect of the countenance is exchanged for a flushed and turgid appearance, the extremities are warm, the pulse full, and the skin is bathed in a warm and often copious perspiration ; sometimes there is a simultaneous evacuation of the bowels, and even of the urine, but the last is almost exclusively a mechanical effect of the compression and percussion to which the abdominal viscera are subjected. When the action of the emetic has terminated, a sense of general relaxation, rather than debility, is experienced, and an inclination to sleep. When this is the case, the patient almost always awakes refreshed and relieved.

The mechanism by which these phenomena are produced consists partly of the contraction of the stomach itself, especially towards its pyloric extremity, but mainly of the pressure to which it is subjected by the diaphragm on the one hand becoming fixed by a suspension of breathing during a full inspiration, and on the other by the abdominal muscles contracting forcibly, so as to thrust the stomach, liver, and intestines against the diaphragm. In the very act of vomiting, the glottis is partially opened, as may be inferred both from the explosive noises which appear to issue from it, and the frequent entrance into it of portions of the matters vomited, which have then to be expelled by coughing.

The operation of emetics is manifold, and is both local and general.

As local stimulants, emetics act by increasing the afflux of blood to the stomach ; and, so long as their immediate impression does not exceed physiological limits, they necessarily render its functions more active, augmenting the secretion of its special glands, while they also tend to diminish whatever congestion of the neighboring organs, and especially of the great secreting viscera, may exist. But the throes of vomiting exercise a direct influence upon those organs, mechanically agitating and compressing them, and therefore both facilitating the discharge of whatever secretion their ducts may already contain, and promoting the formation of a more abundant and easily secreted fluid. Hence emetics deserve to stand first on the list of *deobstruent* remedies. In thus augmenting the discharge of the glands which are subservient to the function of

digestion, they deprive the blood of a large quantity of fluid; not, indeed, as much as certain purgatives abstract, yet sufficient to be considered in estimating the sedative or antiphlogistic influence of the emetic treatment of disease. More particularly is this important, when we remember that their direct sedative impression upon the system, if less permanent, is much more rapid and decided than that of purgative medicines. Nor is their depletory operation, by an increase of secretion, confined to the abdominal organs. The profuse diaphoresis which they sometimes provoke, the discharge of mucus and saliva from the fauces, and the rapid increase of the bronchial secretion under their influence, indicate other important channels in which the effects of their spoliative action are developed.

The direct *sedative* influence of emetic, but more particularly of antimonial medicines, is one of their most important operations, impressing, as it does, both the nervous and the arterial systems. The action upon the nervous system is chiefly manifested in the relaxation of muscular tension produced by various causes directly or indirectly irritating the muscular fibre. In spasmodic laryngitis it controls both the nervous and the vascular elements which constitute that affection, and it is not less efficient in relieving œsophageal spasms, overcoming rigidity of the os uteri, and relaxing the contraction of the muscles which oppose the reduction of a dislocated joint. Even when spasm affects a large portion of the muscular system, the relaxing influence of nauseants and emetics is sometimes used with advantage, but only as a palliative, and in very robust patients. The sedative action of these medicines upon the vascular system is illustrated by its depressing influence on the pulse, and the subsidence of the heat, redness, and swelling of inflamed parts during their administration. These effects, together with the sudorific, emetic, laxative, and revulsive operation of tartar emetic, which will be illustrated more fully elsewhere, render it one of the most powerful among antiphlogistic agents.

The mechanical concussion produced by emetics, and their stimulant action upon the stomach and its associated organs, have been in all ages acknowledged to be of the utmost utility in the treatment of various diseases in which the function of digestion is more or less deranged. But the indications for their use which once were recognized, are now commonly regarded as illusory. Peccant humors, saburra, sordes, vitiated phlegm, and other analogous terms were applied to the real or supposed contents of the stomach, which emetics are fitted to evacuate. As an explanation of these words we may cite the description by Fothergill.[1] "Substances," he remarks, "which have a greater native tenacity than what the powers of the body can overcome, retaining their own nature, corrupt, and pass into a kind of ropy phlegm. The case is the same if the expulsive faculty of the stomach be weakened or hindered, which, as practitioners testify, often happens in debilitated habits; for then,

[1] Works, i. 88.

though the ingesta be not remarkably faulty either in quantity or quality, yet they contract a vitiated quality which arises from it and is increased by their delay in the stomach. Hence arise different species of acrimony; hence the spring of mucus and tough pituitous matter; which, as they separately prevail, or are mixed together, aided by the temperament of the person inclined to this or that, they produce different, and sometimes truly alarming symptoms. So many kinds of depraved appetite; a total loss of it; a diminution or excessive increase of it; a vitiated, lessened, or total want of digestion; or a corruption of the undigested matter, often arise from these as their proximate causes." That this view has not been altogether lost sight of, is proved by the following statement of Sir Henry Holland, who says:[1] "The secretions from the mucous membrane lining this organ [the stomach] are frequently such in kind and quantity, that their removal becomes necessary to all further treatment; and, accordingly, we find that instant good is often derived from emetics, when these matters alone are discharged." If the practice of administering emetics were more common, we believe that the correctness of the above descriptions would not be questioned, and it is also certain that they receive confirmation from the examination of persons who have died while laboring under such symptoms, especially when they occur among the phenomena of bilious remittent fever.

But the question presents itself, Whence do these vitiated secretions arise, and what is their pathological cause? The explanation given by Fothergill, that they are the result of a decomposition of the food, will not bear a moment's examination; for the products of animal and vegetable putrefaction could never be mucus of any description. The mucus, whatever its characters, can have but one source, the muciparous glands of the stomach. These, it is well known, are greatly enlarged in bilious fever and other forms of disease in which the so-called saburral state exists, and their enlargement is frequently associated with more or less thickening or softening, or both together, of the gastric mucous membrane. At the same time the tongue and gums are covered with a thick and pasty coating; the tongue itself is enlarged and flabby and indented with the teeth, and if the state continues, it gradually grows brown and dry; then its crust becomes fissured and ultimately peels off, leaving a raw, smooth, and dark-red epithelium exposed; the breath is also heavy, sour, or fetid. Accompanying this condition, there is also a greater or less degree of febrile movement, often limited to an evening exacerbation, yet usually manifest upon careful observation. In remittent fever, the existence of gastric inflammation, connected with these symptoms, is indicated by tenderness of the epigastrium, or even spontaneous distress in that region, by vomiting, usually of bilious matter, and by a high degree of fever, from which facts it appears to be only a reasonable conclusion that the state in question is a real and not a hypothetical one, and that it

[1] Med. Notes and Reflections, Am. ed., 1857, p. 388.

is the product of a process which, if not inflammatory in the sense of an inflammation produced by a direct irritant, such as arsenic or corrosive sublimate, is nevertheless essentially of that nature. Indeed, in the cases last named, the inflammation attacks the vascular rete of the mucous membrane, while in those especially under consideration as proper subjects of an emetic treatment, the glandular element is the seat of the peculiar alteration.

That emetics should be useful under such circumstances we must admit, not only as the result of direct experience in the gastric affections referred to, but also as a legitimate deduction from the admirable effects of stimulant remedies in follicular inflammation of the fauces and larynx, applied directly to these parts, and also from the utility of medicines addressed to the stomach in the same affections, and which were long successfully employed to cure them before the topical medication of the accessible parts came into vogue. Indeed, a principal cause of the frequent failure of the latter is that it is often employed alone, and without a due consideration of the symptoms which point to a derangement of the stomach itself.

If, now, we reflect upon the operation of emetics as thus far described, we shall find in it a probable explanation of their value in the affections which are characterized by enlargement and an altered secretion of the mucous follicles of the stomach, whether we prefer to call this state inflammatory, or regard it as a perversion of function only. That it cannot with propriety receive the former title, purely and simply, is plain, because it tends neither to interstitial effusion nor to ulceration; yet it must be admitted to be sometimes associated with diffuse inflammation of the mucous membrane, as in some fatal cases of bilious remittent fever.

The so-called stimulant action of emetics has been referred to as being either immediate and remote, or local and general. Their local stimulant property has, in some degree, been illustrated; their more general or remote effect is the consequence mainly of their local operation. It is not easy to perceive in this effect much more than the twofold influence which has already been pointed out as belonging to emetics, a local irritation tending to draw the fluids of the body to the stomach and evacuate them there, in so far diminishing the congestion of remote parts; and, in addition, a general perturbative action which tends to arouse the activity of organs which come within the sphere of its influence, in consequence of their taking a greater or less share in the act of vomiting. It appears very doubtful whether this influence is more than mechanical, and whether it is curative in any other way than by relieving the oppressed organs of the physical impediments to their free exercise. It is usually, however, explained by a reflex influence exerted through the nerves, as was suggested by Fothergill long before the rise of the theory of reflex nervous action. According to him, the local impression of the emetic upon the stomach "is propagated to the origin, termination, and extremities of the nerves, and also to the branches shooting off to the opposite region of the

body;"[1] and by such a stimulant influence he explained the usefulness of these medicines in congestion of the brain, epilepsy, hypochondriasis, and chorea, and on a similar ground proposed them in spasm of the glottis. Now, an observation of the effects of other remedies, and especially of purgatives, in these disorders leaves, we apprehend, no doubt that in all of the cases enumerated by Fothergill, whatever remedies have been found curative do, and necessarily must, act by relieving certain affected parts of over-excitement, withdrawing it from them and scattering it through the system, or fixing it upon another locality in which it will cease to disturb the general harmony of the functions, or else, finally, by directly relaxing the spasm which constitutes the prominent phenomenon of the disease. The action, then, which has been attributed as stimulant to emetic medicines is, in reality, often revulsive or perturbative, or else a directly sedative action.

The *general indications* for the use of emetics may be inferred from what has already been said regarding their mode of action. The primary and most important one is the spontaneous effort of the stomach to reject its contents, as indicated by persistent nausea and retching. If the organ is in a state of repletion, or is known to contain a noxious substance, the propriety of administering these medicines is unquestionable; but it is not so easy to decide this point in the absence of such an indication. Nausea and vomiting are symptoms of affections of the stomach, such as simple and cancerous ulcer, and active inflammation from acrid poisons, which would almost certainly be aggravated by the action of even the mildest of the emetic medicines. In these cases, therefore, they should be avoided; and whenever acute and active gastritis is indicated by high fever, a red and dry tongue, intense thirst, burning pain and tenderness on pressure in the epigastrium, and the vomiting of everything which is swallowed, they would prove exceedingly mischievous, and, perhaps, fatally so. But, on the other hand, if the tongue is covered with a thick, pasty coating, of a sweetish, bitter, saltish, or sour taste; if the breath is heavy or fetid; if there exist a loathing of food, nausea, or straining, with a feeling of sinking or great oppression at the epigastrium, and eructations of a sour, acrid, or bitter liquid, and if, in addition to these symptoms, the complexion has an earthy or dull hue, and the sclerotica a muddy or jaundiced aspect, the propriety of administering an emetic cannot be for a moment doubted.

As regards the *contraindications* for the use of emetics, in addition to gastric inflammation or disorganization already mentioned, there are but few circumstances in which they are absolutely inadmissible. Undoubtedly, they should be cautiously employed in all cases of imminent hemorrhage from any organ, whether uterine, cerebral, pulmonary, or any other; but the absolute objection to them sometimes inculcated, appears to be based upon theoretical rather than upon practical grounds; for it does not appear that ipe-

[1] Works, i. 79.

cacuanha, at least, has ever been charged with any disasters of the nature referred to; and if some rare instances of the sort have been alleged against tartar emetic, they should not be allowed to deprive us of the advantages derivable from other articles of the same class. It is well known that emetics have been successfully used to check pulmonary and uterine hemorrhage; and it is questionable whether a single instance of fatal consequences from this use of them is recorded. At the same time it is, perhaps, the part of prudence, in all of the disorders referred to, to make use of the milder and less exhausting articles of the class. Whenever a patient is affected with hernia, prolapsus of the rectum or uterus, enlargement of the abdomen from pregnancy, a hypertrophied organ, a morbid tumor, or even a large collection of fæces in the intestine, emetics are, indeed, not contraindicated, but should be circumspectly used, and the mildest articles of their class preferred.

As a general rule, nauseant emetics are unsuitable to persons advanced in life, because they depress the heart and tend to augment unduly the bronchial secretion; but mechanical emetics, such as sulphate of zinc, copper, or alum, may be administered without apprehension in appropriate cases. On the other hand, emetics are of all medicines the most useful in many diseases of children. Young persons vomit without much effort; indeed, it seems with infants to be a normal act for relieving an oppressed stomach, and many of the diseases incident to childhood are treated by no class of remedies so successfully as by these. Especially may they be regarded as a most precious resource in affections of the air-passages in early life. But this remark scarcely applies to tartar emetic, whose sedative powers are often developed in children with frightful violence and fatal effect, and by doses which, when prescribed, were expected to produce only nausea, or gentle vomiting at the most.

Something of a similar, and what may be called a poisonous effect of emetic medicines, is occasionally met with even among adults, and suggests caution in their use. Violent vomiting and purging and general collapse have, in numerous instances, been observed to result from a fractional dose of tartar emetic, and, in some rare examples, a similar susceptibility to the action of ipecacuanha has been noticed. On the other hand, a remarkable insensibility to these and to other emetics has sometimes been noticed as a personal peculiarity, and it also ordinarily exists whenever the brain is morbidly excited, as in cases of inflammation of this organ, and during the functional excitement of mania and delirium. The same torpor of the stomach is noticed in an apparently opposite condition of the brain, viz., when it is rendered torpid by narcotic medicines, and when it is subjected to mechanical compression resulting from external violence, or from disease within the cranium.

Of all the untoward effects of emetics, the gravest is coagulation of the blood in the arteries, in consequence of prolonged syncope, or extreme collapse. Trousseau quotes several examples of this accident. Wepfer relates the case of a female who was attacked with violent vomiting, followed by prolonged syncope. Soon afterwards

she was seized with a very acute pain in the right foot, which, on the following day, was affected with gangrene. In another case the nose, lower lip, chin, and several toes sphacelated; and in a third case the same parts, and also the hands, were attacked, and one of the feet, besides several toes of the other foot, was lost. It is possible that these unfortunate effects were due to coagulation of the blood in the arteries.

Forms of Disease in which Emetics may be used.

Fevers.—The use of emetics in *continued fever*, by which term we here intend to designate not only typhus and typhoid fevers, but ephemeral, simple continued, and eruptive fevers, is advantageous chiefly, if not exclusively, in the forming stage of the attack, before the conditions of the disease are permanently fixed. At this period they often manifest a clearly moderating influence upon the subsequent course and grade of the symptoms, but probably cannot be depended upon for effecting a cure. During epidemics of the graver forms of these affections, however, when certain premonitory symptoms announce the approaching attack, it may not unfrequently be arrested by the thorough operation of an emetic, which, in this case, exerts its eliminative and perturbative action together. The palliative influence spoken of above, is strikingly exhibited in all the forms of *eruptive fever*, provided that the cases selected for its use are of a sthenic type, that it be employed before the appearance of the eruption, and that sedative emetics be not selected for the purpose. Under the circumstances referred to, the use of tartar emetic would be in the highest degree hazardous. It will be observed that all of these forms of fever except, perhaps, the ephemeral, are strictly blood diseases, and, therefore, that an eliminant treatment, which is, on the whole, sedative rather than stimulant, cannot be expected to furnish the most favorable results. *Periodical fevers*, the phenomena of which are manifested chiefly by a peculiar disturbance of the nervous system, are much more advantageously treated by emetics. The simpler forms of intermittent fever, and especially the vernal cases, may often be cured by these medicines alone; as Fothergill expresses it, "their operation seems something wonderful." As regards autumnal fevers, and in proportion as they assume a bilious type, the same treatment is invaluable in many cases which refuse to yield to the administration of quinia alone. It must have happened to every physician to meet with instances of the disease for which bark seemed to have lost its virtues, until an emetic, perhaps combined with a cathartic, placed the system in a condition favorable for the action of the specific remedy. In many cases, also, when an irregularity of the paroxysms, whether of degree of development, or in the order of succession of the stages, or when some other departure from the normal type exists, the operation of an emetic restores the phenomena to their due sequence and proportion, and renders the disease easily curable by the specific remedies.

Inflammation.—There are few inflammatory affections in which emetics are not serviceable by one or another of their modes of operation, but in nearly all their utility is most conspicuous, as it is in idiopathic fevers, before the full development of the attack. It is enhanced in the greater number of diseases of this class, by the previous employment of depletory measures. Of their use in *spasmodic laryngitis*, comprising an inflammatory and a nervous element, we have already spoken; and in *pseudo-membranous laryngitis*, nauseant emetics are valuable during the first stage for limiting and restraining the violence of the inflammation, and subsequently, mechanical emetics for expelling the obstructions of the air-passages. Quite an analogous mode of operation is displayed by these remedies in *bronchitis* and *influenza*, that is to say, they promote the bronchial secretions, and at the same time occasion their discharge; and the mechanical emetics are of the greatest value in those forms of bronchial disease, such as *bronchorrhœa*, in which the inflammatory element is slight, or null, but the amount of secretion excessive. Cases are on record in which the administration of an emetic by the rectum, or its injection into the veins, has caused the expulsion of a foreign body lodged in the larynx; and the same means have been used to clear the air-passages of newborn children of mucus, and thereby dissipate the *asphyxia* which would else have proved fatal. The forming stage of *tubercular phthisis* has been treated by emetics with alleged advantage. They are presumed to have been useful by their tending to produce the elimination of the imperfectly concreted deposit. In *pneumonia*, after the first stage, the sedative action of emetics is chiefly to be regarded, and, indeed, it is less as an emetic than as a sedative that antimony has been supposed to be valuable in this affection.

In inflammations of the *digestive organs* the uses of emetics are manifold. No other remedy acts so promptly to cure *tonsillitis*, *parotitis*, *ulcerative stomatitis*, and *aphthæ*, or follicular ulceration of the mouth. The affections of the *stomach* which are benefited by emetics have already been pointed out as comprising those which are not of a purely inflammatory type, nor structural in their nature, and the same is true of enteric disorders. One among them is an exception to this statement, and that is *dysentery;* but the only emetic which favorably influences it is ipecacuanha. Wherefore it may be concluded that the curative power of the medicine, like the disease it cures, is specific, and not dependent upon its evacuant or its sedative operation. *Jaundice* has sometimes been treated with emetics, under the impression that the discoloration of the skin is always due to the presence of inspissated bile or some other mechanical obstacle in the ducts; but the want of success of such measures, and a better knowledge of the causes of this affection, have led to an abandonment of the method, except in the slighter cases free from any threatening symptoms.

In several diseases of the *nervous system* emetics are of signal service. *Apoplectic* symptoms produced by sanguineous congestion or effusion within the cranium cannot be safely treated by these

medicines, or, at least, not unless the free use of depletory means has proved unavailing. Consequently in all cases in which paralysis accompanies loss of consciousness with a full pulse and injected countenance, they ought not to be employed. When the pulse is feeble, and the skin pale and cool, there is more reason to expect them to be useful. When cerebral symptoms arise from *narcotic poisoning*, or from *indigestible food* in the stomach, an emetic is the natural remedy, and in the latter case, indeed, is sometimes indicated by spontaneous attempts at vomiting. This class of medicines is perhaps the most efficient of all in *delirium tremens*, and still more so in *mania-à-potu*, or the affection produced as the direct and immediate effect of intoxicating drinks. *Insanity*, especially of the melancholic form, has sometimes been advantageously treated by emetics; but they are less serviceable than cathartics, at least when used alone. In combination with the latter medicines, and in the form of the disease just indicated, they have in all ages been renowned for their efficacy. A spasmodic affection in which they should not be neglected is *singultus*.

Of other diseases which are sometimes benefited by emetics, it may be sufficient here to mention *dropsy*, which they may cure when the effusion is independent of mechanical causes, and palliate when it originates in such causes, by an influence exerted upon absorption and secretion; *rheumatism* in its forming stage, the progress of which the diaphoretic action of emetics may then arrest; *erysipelas*, especially of the face, which is often associated with gastric derangement and bilious symptoms; *swelled testicle*, for which, in its commencement, an antimonial emetic, followed by nauseating doses of the same medicine, is sometimes a speedy cure, etc. It is unnecessary to supply a greater number of illustrations of the curative operation of emetics, as it will be fully treated of in connection with the individual medicines of this class.

Emetics may be classified according to their origin in the vegetable or mineral kingdom; but this is an arrangement of no practical value, except as facilitating the search for any one of the class in systematic works which treat of them. Or they may be grouped according to the grade of their action, the mildest being oil and tepid water, or bitter infusions, which operate chiefly by their bulk, but somewhat by their nauseous taste; then follow mechanical emetics, so called, including the sulphates of copper, zinc, and iron, and the sulphuret of mercury; next to these, horseradish, mustard, and squills, which nauseate but do not depress; ipecacuanha might then be considered, standing almost alone in its peculiarities, but more analogous to squill than to any other of its associated medicines; and finally, white hellebore, tobacco, and tartar emetic might be grouped together as being all powerful sedatives and emeto-cathartics. But the greater number of the substances now enumerated belong to other classes of the materia medica, the expectorants, diaphoretics, nervous sedatives, irritants, etc., and it would, therefore, be inconvenient and unprofitable to introduce a description of them into the present division of the

work. Their emetic virtues will be found treated of in connection with the several articles which have been named.

The unequal degrees of emetic effect possessed by these medicines, and the different actions conjoined with it, render it impossible to substitute one for another indifferently in the treatment of disease. If it be intended merely to evacuate the stomach without inducing any constitutional effect, some one of the group of mechanical emetics which act by their bulk or by their local irritation only, or one of the irritant group which nauseate but slightly, should be preferred; but if a constitutional effect involving the condition of the nervous system, the circulation, and the secretions is desired, then some of the nauseant articles will be selected, and, according to the nature of the case, those which produce a slight and transient, or a profound and prolonged depression of the economy. Of this last group, ipecacuanha stands on one side, and tartar emetic on the other. The former should generally be preferred when the patient is young or delicate, and when the bowels are relaxed; the latter is more appropriate for robust and plethoric persons, when it is intended to agitate the whole system, and when a purgative operation, in addition to emesis, is sought to be produced.

The Administration of Emetics.—The mode in which emetics should be administered will depend upon the object in view. When it is proposed merely to evacuate the stomach, as when some poisonous agent or improper food has been taken, a large quantity of lukewarm water, or of a weak, bitter infusion, should be given in frequent and copious draughts, so as to produce the most rapid discharge of the offending substance, with the least possible irritation of the organ itself. Or one of the mechanical emetics may be administered, and after vomiting has commenced, draughts of the diluent liquids referred to will be found useful in sustaining while it moderates the operation. In such cases ipecacuanha may also be employed alone, or in conjunction with other emetic substances, if they should prove insufficient of themselves, and in all such cases the full dose judged necessary should be administered at once.

But when it is intended to make a strong impression upon the system, by means of the perturbative action of the medicine, to promote the secretions, and reduce excitement, a more prolonged emetic operation is required. This may be secured by administering the emetic upon an empty stomach, and in portions of one-fourth or one-third of the whole dose prescribed, at intervals of ten or fifteen minutes, until efforts at vomiting begin to be made, or emesis has actually commenced. Small portions of liquid may then be allowed, but when the evacuation has been pretty complete, and not before, should copious draughts of lukewarm liquids be taken to moderate the severity of the straining, and thoroughly to clease the stomach. In general, the operation ought not to cease until bile has been evacuated.

If the vomiting continues longer than is intended, or than is necessary, it may be moderated by the use of neutral mixture with the addition of a little hydrocyanic acid; by a small quantity of

lemon-juice, or of peppermint, or other aromatic water; by a full dose of morphia, or an enema containing forty or fifty drops of laudanum; or by an aromatic plaster or poultice applied to the epigastrium.

For some hours afterwards no food should be taken, and for one or two days it should consist only of unirritating and digestible articles.

ZINCI SULPHAS.—Sulphate of Zinc.

History.—This salt has been known since the beginning of the fourteenth century, when it was prepared in Carinthia out of the ores of zinc. It was called Gilla by Paracelsus, who first taught how to purify it, and who used it medicinally. In 1735, its composition was shown by Brand.[1] Native sulphate of zinc is said to exist at Rammelsberg in the Hartz Mountains, near Goslar, and also at Holywell in Flintshire, England, and in other places.[2] It is commonly known as *white vitriol*, and is prepared artificially by dissolving zinc in diluted sulphuric acid.

Action. *On Animals.*—According to the experiments of Orfila and others, this substance inflames the mucous membrane of the stomach, after having produced active vomiting with epigastric pain. Vomiting is still the most prominent symptom even when a solution of the salt is thrown into the jugular vein of a dog.

On Man.—The local action of sulphate of zinc is astringent and drying, but if its application is continued, it becomes irritant and caustic. Toulmouche found that in doses of two grains it seldom produced vomiting. In four grain doses it occasioned some vomiting, with liquid stools in more than half the cases. Doses of six, eight, ten, and twelve grains almost always produced vomiting, and purging about half as often. Doses of fifteen grains caused vomiting in one-third only of the cases, and diarrhœa in two-thirds. In nearly all there was more or less colic, but very little nausea.[3] Although examples are not wanting of death produced by sulphate of zinc, yet the number of them is small. In general, the emetic quality of the medicine insures the speedy rejection of a large dose, or at least of its greater part. Large doses of it (thirty grains or more) produce a styptic taste in the mouth, constriction of the fauces, pain in the stomach and bowels, retching, violent vomiting, purging, distress, thirst, a contracted pulse, cold extremities, and sometimes death.[4]

Dr. Brennan has reported the case of a man who took four ounces of sulphate of zinc in mistake for Epsom salts. It was dissolved in five ounces of warm water. Immediately he experienced a sense of violent distension in the head, was seized with coldness, shivering, and prostration; his features were contracted and of a leaden

[1] Richter, Ausfür. Arzneim., iv. 530.
[2] Pereira, Mat. Med.
[3] Dierbach, Neueste Entdeck., iii. 520.
[4] Wibmer, Wirkung, etc., v. 468.

hue, and he felt a choking sensation with constriction around the chest. Spasms affected the eyeballs and upper extremities; there was tenderness in the throat, epigastrium, and abdomen; the respiration was 15 and feeble, the pulse 60 and languid, and there was incessant vomiting and purging. The mind was clear, and the patient recovered. Diarrhœa continued for several days.[1] In a case which proved fatal on the fifth day after the drinking of a wineglassful of a concentrated solution of this salt, no morbid appearances were detected, except patches of red inflammation of the mucous membrane of the pyloric end of the stomach and of the duodenum.[2]

The secondary effects of the medicine, or those which result from its absorption, rank it among tonics and astringents. Probably, as a still more remote effect, its action is antispasmodic. It has also been thought to exert a specific action upon the bronchial tubes, by diminishing the secretion of their mucous membrane.

Uses. *Externally.*—It is chiefly employed for the sake of its astringent qualities, and both in solution and in the form of an ointment. The former is frequently used in subacute and chronic inflammations of the conjunctiva, of the auditory and nasal passages, the throat, vagina, and urethra, and also after the extirpation of polypi from any of these parts. Michaelis highly recommended a wash composed of this substance with extract of cinchona, catechu, and honey of roses, in the treatment of *cancrum oris*. Armstrong and others employed it successfully for the cure of *aphthæ*. The strength of the solution employed must be determined by the sensibility of the inflamed membrane. In *ophthalmia* collyria should seldom contain more than one grain of the salt to an ounce of water, and the same proportion is suitable in *gonorrhœa*. For *leucorrhœa*, a somewhat stronger preparation is more effectual. Wishart employed successfully the following solution in *ophthalmia neonatorum*:[3] ℞.—Sulph. zinci, gr. xx; aquæ, ℥x; liq. plumbi subacet. gr. xxx; tinct. camphoræ, fℨj–ij. A portion of this mixture was injected between the lids by means of a syringe, from three to six times a day. As an application to the nasal passages, to the mucous membrane of the mouth, throat, etc., a solution of ten grains to the ounce is not too strong. It has been used successfully to arrest *coryza* in its forming stage, as well as to moderate an excessive purulent discharge from the nostrils. Injections of a solution of the salt into the *bladder* have also served to arrest *hemorrhage* from this organ. In *epistaxis* a plug of cotton-wool covered with finely-powdered sulphate of zinc has been successfully employed. In *chronic discharges* from the genito-urinary organs of either sex it has been recommended as an internal medicine. Injections of sulphate of zinc dissolved in water have been advantageously applied to arrest uterine *hemorrhage*, but they are probably more effectual

[1] Lancet, July, 1865, p. 52.
[2] Times and Gaz., Sept. 1862, p. 252. For other cases consult TARDIEU, Annales d'Hygiène, Oct. 1871, p. 329.
[3] Edinb. Med. and Surg. Journ., Oct. 1829, p. 253.

in bleeding from fungous growths of the uterus or vagina. It may also be used to arrest hæmorrhoidal discharges. *Polypi* of the nostrils have been made to shrivel by means of insufflations of powdered sulphate of zinc, so that they could be more readily extirpated by means of the forceps. As before remarked, a solution of the salt has been employed to prevent the reproduction of such tumors. Lisfranc had recourse to a solution of the sulphate (gr. xl to ℥j), which he applied lightly by means of a camel's hair pencil after the inflammation caused by the removal of the polypus had subsided.[1] It has also been employed to prepare washes and ointments in a variety of cutaneous affections, particularly *chronic eczema* and *scabies.*

Dr. J. Y. Simpson has recommended anhydrous and finely levigated sulphate of zinc made into a paste with glycerin (glycerin, gr. lx; prepared sulphate of zinc, ℥j), or with lard (lard, gr. cxx; prepared sulphate of zinc, ℥j), as a caustic application to indurated *ulcers* of the *cervix uteri*, *lupus* of the face or *impetigo rodens*, sensitive *tumors* of the female *urethra*, *condylomata*, etc. It will not act upon parts covered with cuticle or epithelium, but on the denuded tissue beneath it produces severe burning pain, which may be palliated by applying along with it a salt of morphia. Its eschar is stated to separate more rapidly than that of most other caustics, viz., on the fifth or sixth day, and it is further recommended by its perfect safety and its having no tendency to deliquesce or spread.[2]

Internally.—This substance was formerly much more employed than at present as an *emetic.* It was used especially, in doses of from ten to twenty grains, for the purpose of evacuating the stomach, without producing nausea or diarrhœa, in cases of *narcotic poisoning*, *indigestion*, etc. Some writers, indeed, as Gmelin and Moseley, contend that it rather fortifies the stomach than weakens it; but this opinion may very plausibly be questioned. On account of its mechanical mode of producing emesis it has been much employed in *croup* to promote the expulsion of false membranes from the air-passages. One of the earliest instances of its successful use for this purpose occurred in the practice of Dr. Francis, of New York.[3] It is also reported to have been very efficient in curing epidemic *diphtheria.*[4]

Sulphate of zinc has been much used as an astringent in chronic affections of the bowels attended with diarrhœa. Moseley attached great importance to it in the treatment of tropical *dysentery*, but as he prescribed it in combination with alum and cochineal, its precise efficacy cannot readily be inferred.[5] Baumgartner employed it in *typhoid fever*[6] with the object of healing the intestinal ulcers which have erroneously been looked upon as the starting point of the symptoms of the disease. So far as these local lesions are concerned, it may undoubtedly promote their cicatrization, while

[1] Bull. de Thérap., xviii. 213.
[2] Times and Gaz., Jan. 1857, p. 56.
[3] Hosack's Essays, ii. 170
[4] Boston Journ., Feb. 1862, p. 31.
[5] On Tropical Diseases, p. 402 et al.
[6] Richter, op. cit., suppl. Bd. p. 559.

it strengthens the nervous system and moderates the diarrhœa. Baumgartner prescribed it in solution, and in doses of two or three grains three times a day. In obstinate *intermittent* fever it sometimes proves efficacious.

W. Phillip alleged that sulphate of zinc is useful in certain forms of *dyspepsia*, but the cases in which he found it so are not very distinctly described. They were such, probably, as those in which the medicine was recommended by Moseley and by Strong, cases distinguished by constipation and by flatulent distension after meals. Dr. Strong directed a pill containing three grains of the medicine to be taken four or five times in twenty-four hours.[1] From the general efficacy of tonics in removing this form of disease, and, contrary to prevalent opinions, in overcoming a constipated state of the bowels, the utility of the sulphate of zinc may be readily understood. Dr. Woodman relates a case of acute general *urticaria* which was promptly cured by an emetic made with a drachm of the salt dissolved in half a pint of water.[2]

Sulphate of zinc has been highly recommended in several nervous disorders. In some cases of nervous *palpitation of the heart* it has seemed beneficial. Spasmodic *asthma*, spasmodic *coughs*,[3] and even *whooping-cough*, are said to have yielded to it. Dr. Fuller,[4] in 1847, employed it in fifty-seven cases of the last-mentioned disease, and found it to give speedy relief in all but four of them. Subsequently, in 1858, he associated belladonna and zinc, with greatly superior results. He prescribed half a grain or a grain of sulphate of zinc and a sixth of a grain of extract of belladonna every three or four hours, increasing the total quantity every day or every alternate day by one grain of sulphate of zinc and one-sixth of a grain of belladonna, until the quantity taken daily amounted to from six to sixty grains of zinc and from two to six grains of the extract of belladonna, according to the age of the patient. If the dose is very gradually increased, it will not occasion sickness. That the efficacy of this compound treatment is mainly due to the belladonna which enters into it, does not admit of a doubt. (Vid. *Belladonna.*) *Inhalation* of the vapor generated by the steam atomizer with a solution of the sulphate of zinc is of signal benefit in chronic forms of *bronchitis* with profuse secretion.

Under the administration of sulphate of zinc numerous cures of *chorea* have been effected. Dr. Hughes[5] has published a summary of sixty-three cases of this disease in which it was administered, and of that number forty-five recovered. The dose given at first was two grains three times a day, and it was afterwards gradually increased until in some instances no less than thirty-six grains were taken at a dose. Romberg[6] says that it has not merited much praise in the cases that have fallen under his observation, and this state-

[1] Edinb. Med. and Surg. Journ., Oct. 1842, p. 408.
[2] St. Andrew's Med. Grad. Trans., v. 228.
[3] Moseley, op. cit., p. 558; Times and Gaz., Feb. 1862, p. 109.
[4] Dis. of the Chest, p. 335. [5] Guy's Hospital Reports, 1846.
[6] Diseases of the Nervous System, p. 75.

ment accords with the more recent results arrived at by Mr. Stone, who compared the curative operation of sulphate of zinc, arsenite of potash, and ferruginous preparations in groups of cases amounting to fifty in all. The result failed to confirm the usual estimate of the value of sulphate of zinc in this disorder. The iron seemed to act more certainly, and the arsenic both more certainly and more rapidly, than zinc.[1]

Administration.—As an emetic, sulphate of zinc may be given in doses of from *ten* to *thirty* or even *sixty* grains, largely dissolved in water. For other internal uses, *two* grains three times a day may be prescribed, and the quantity gradually increased until it reaches twenty or more grains. For external application, the ordinary strength of the solution of this salt should be from *one* to *three* or *four* grains to a fluidounce of water.

ANTIMONII ET POTASSII TARTRAS.—TARTRATE OF ANTIMONY AND POTASSIUM; TARTAR EMETIC.

Description.—Tartrate of antimony and potassium is prepared by boiling water and bitartrate of potassium with oxide of antimony. "It is in the form of transparent, colorless crystals, which possess a nauseous, metallic, styptic taste, and have usually the form of rhombic octohedrons. When exposed to the air, they effloresce slightly and become white and opaque. In the shops it is found as an amorphous powder. It is insoluble in alcohol, but dissolves in proof spirit and wine. It also dissolves in about fifteen parts of water at 60° F., and in between two and three parts of boiling water." Its aqueous solution reddens litmus slightly, and, when kept for some time, undergoes decomposition, and forms a soft, flexible, mucilaginous mass, composed chiefly of algoid plants. "It is incompatible with acids, with alkalies and their carbonates, with some of the earths and metals, with chloride of calcium, and with acetate and subacetate of lead." It is also incompatible with astringent vegetable infusions and decoctions; but they do not, unless the preparations of galls be exceptions, render it inert, although they lessen its activity.

EMPLASTRUM ANTIMONII.—*Antimonial Plaster.*

This plaster is prepared with one part of tartrate of antimony and potassium to four parts of Burgundy pitch.

VINUM ANTIMONII.—*Antimonial Wine.*

It is prepared by dissolving thirty-two grains of tartrate of antimony and potassium in a fluidounce of boiling distilled water, and adding sufficient sherry wine to make the solution measure a pint.

UNGUENTUM ANTIMONII.—*Antimonial Ointment.*

One part of tartrate of antimony and potassium to four parts of lard form this ointment.

[1] Times and Gaz., Sept. 1859, p. 281.

History.—The origin of the word *antimony* is uncertain. It is, indeed, commonly said that the chemist and monk Basil Valentine poisoned a number of his brethren by purging them too much with it; hence in French it might significantly be called *antimoine*.[1] The story is elsewhere told with some variations. A German monk, Valentine, having thrown to the pigs some antimony which he had used to promote the melting of other metals, found that, although it purged the animals very actively, they nevertheless grew fat. But on trying the same experiment upon his brethren, the monks, he met with such indifferent success that they all died.[2] It is more probable that the word is a corruption or imitation of the Arabian term for this metal, *atimad*.

The first mention of the medicinal virtues of antimony was by Basil Valentine. He seems to have been acquainted with the teroxide (*flores antimonii*), the red sulphuret (*sulphur of antimony*), and the terchloride (*butter*) of antimony. This was at the close of the fifteenth or at the beginning of the sixteenth century. Paracelsus, who lived at the same period, contributed much to bring antimonial medicines into vogue, but he also helped to divide the medical profession into two hostile camps, which for a long time carried on a furious contest relative to these preparations.[3] So bitterly were their partisans denounced, that in 1556 the opponents of the medicine succeeded in obtaining a decree of the Faculty of Physic at Paris, backed by an act of the Parliament, which condemned antimony as a poison, and prohibited its use. Antimonials continued, notwithstanding, to be used, but probably by irregular practitioners, for as late as 1600 a physician named Besnier was expelled from the Faculty for having prescribed them.[4] In 1637, however, antimony was received into the officinal codex, or pharmacopœia, as a purgative, and thirty years later (1666) the original decree against the remedy was rescinded by the Parliament, upon the petition of the Medical Faculty itself. During the period of this controversy (1619), Mark Cornacchini, Professor in the University of Pisa, announced as almost a panacea, and soon brought into vogue, a powder composed by the Earl of Warwick, and which consisted of scammony, sulphuret of antimony, and cream of tartar.[5] Very probably, by observing the reaction of these substances, Mynsicht, of Mechlingburg, was led to the discovery, in 1631, of the preparation of antimony which forms the subject of this article, and to which he gave the name of tartar emetic.

Action. *On Animals.*—Viborg found[6] that when this substance was injected into the *veins* of horses in doses of from twelve to thirty grains, it occasioned a frequent and small pulse, trembling and twitching of the muscles of the skin, gaping, and a drooping look. On the injection of sixty grains the symptoms were very striking. The pulse grew very frequent, and the breathing spas-

[1] ALLSTON, Mat. Med., i. 295.
[2] Querelles Littéraires, iv. 82.
[3] ALLSTON, loc. cit.
[4] SPRENGEL, Hist. de la Méd., iii. 121.
[5] Biographie Universelle, ix. 597.
[6] WIBMER, Wirkung, etc., v. 187, 194.

modic and noisy; there were thin dejections, a copious secretion of sweat, tears, and saliva; automatic movements of the lips and of the tongue, as in the act of licking, a grinding movement of the lower jaw, restlessness, stretching of the limbs, scratching of the flanks with the hinder feet, repeated movements of the head towards the same parts, and tremulousness with spasms of the shoulders, neck, and hams. When the quantity injected reached one hundred and twenty grains, the symptoms were sudden and violent. They consisted of cramps, vertigo, paralysis, and death within three hours. According to Lappe and Hertwich, when the substance was administered by the stomach in doses of one or two drachms every three or four hours, there occurred, sooner or later, diarrhœa, debility, increased secretion from the mucous membranes, and, if the medicine was continued, a sort of typhoid condition, with diminished plasticity of the blood. Half an ounce given at a single dose caused frequency of the pulse, thirst, borborygmi, and muscular spasms. An ounce caused death, but only when administered in solution, in about eight hours; two ounces produced the same result in two hours and a half. Experiments upon *dogs* with this substance have been performed by many persons, and in various ways. The first among them, Courten (1678), has furnished nearly as complete an account of its effects as any of his successors. When injected into the veins a solution of from three to eight grains occasioned death in the course of two or three hours. In some of Magendie's experiments from twelve to eighteen grains were employed, and produced death within half an hour. The symptoms were depression, retching, vomiting, purging, nausea, and hurried breathing, restlessness, a rapid pulse, spasms of the limbs, moaning, exhaustion, and death. The heart and lungs, after death, were found distended with dark blood, and there was vascular injection of the stomach and duodenum. Magendie, on administering tartar emetic by the veins to an animal whose stomach had been removed and replaced by a bladder, found that vomiting was still excited by the contraction of the diaphragm and abdominal muscles. This, however, does not exclude the action of the medicine directly upon the stomach even when thus introduced into the system. Indeed, Dr. Brinton showed that when injected into the veins of an animal, it is in great part eliminated by the stomach.[1]

Pecholier, in his experiments upon animals, found the rate of the pulse to fall, on an average, twenty or twenty-five beats a minute under the influence of doses of one or two grains; the rate of the respiration and the temperature declined in a like proportion.[2] The more minute experiments of Ackermann[3] confirm this statement, showing that immediately after the injection of a solution of tartar emetic into the veins the pulse rises rapidly in frequency, even by as much as fifty strokes in a minute, after which it sinks

[1] Cyclopæd. of Anat., suppl., p. 319.
[2] Bull. de Thér., lxiv. 518.
[3] VIRCHOW'S Archiv, xxv. 531.

below its original rate. After poisonous doses the acceleration of the pulse is slight and transient, but its decline in frequency rapid until a few minutes before death. It also becomes irregular. Uniformly the pressure of the arterial column is diminished, while the duration of the pulse wave is lengthened. The reduction of arterial tension necessarily implies diminished power in the heart, and, as a consequence, the venous system, being no longer fully relieved of its blood, becomes everywhere engorged. Thus, during life, parts like the tongue and gums, which in health possess the hue of arterial blood, become first pale and then dusky in color. These conditions explain in a great measure the decline of the animal temperature, which falls the lower the longer they last.

From a very carefully conducted series of experiments upon animals, Dr. Richardson drew various conclusions, of which the following is a summary: 1. Tartar emetic excites the same symptoms in dogs as in man. 2. All the permeable tissues absorb it, and its effects are specifically the same by whatever channel, including the blood, it may enter. 3. After absorption it may be detected in the blood, the serum, the urine, and all the organs. 4. It excites marked local effects in any membrane by which it is eliminated, and hence, however introduced into the system, it causes redness of the lining membrane of the stomach, and the symptoms which attend its direct application into this organ. 5. In large doses it produces vomiting and purging, and rapid collapse; but small doses long continued may cause death by exhaustion. 6. The immediate cause of death from this agent is, in all cases, failure of the heart's action. 7. The post-mortem lesions produced by it are general congestion; fluidity of the blood; intense vascularity of the greater curvature of the stomach, and in some cases of the rectum, and other parts of the intestinal tube, but without ulceration; and a pale-yellow, glairy mucous secretion. 8. In rapid poisoning by tartar emetic the fatal effect seems due to a direct chemical change in the blood, and an indirect effect therefrom upon the heart; while in slow poisoning there is added an interference with the assimilative powers, the result of the lesions excited in the stomach or other parts of the alimentary canal.[1] Dr. Nevin's experiments upon *rabbits* with comparatively small doses of tartar emetic, illustrate its power of producing gradual emaciation in these animals.[2] The experiments of Hertwich and Viborg show that *pigs* support the action of tartar emetic remarkably well. In doses of from ten to sixty grains given to pigs of less than a year old, it produced vomiting and debility, but no severer symptoms. When the dose was raised to one hundred and twenty grains there were, in addition, signs of suffering, great thirst, convulsions, and death. Daubenton observed diarrhœa, distension of the paunch, and grinding of the teeth, as effects of the medicine given to *sheep*. By experiments upon cats, dogs, etc., it has been found that its specific

[1] Times and Gaz., May, 1856, p. 473.
[2] Liverpool Med. Journ., Jan. 1857, p. 43.

effects were produced by injecting a solution of it into the *cellular tissue ; i. e.*, there was vomiting, with depression, etc. ; the gastro-intestinal mucous membrane was found injected, and there was much congestion of the lungs. The experiments of Pecholier, which confirm the more important of the above conclusions, add nothing new to our knowledge of the subject.[1]

On Man. Endermically.—The first idea of administering tartar emetic by the skin was suggested by Blizard, but the earliest application of it to the treatment of internal diseases was made by Mr. Sherwen, in 1787.[2] According to him, if a solution of tartar emetic is rubbed into the palms of the hands, it produces a burning sensation in those parts, with nausea, perspiration, rumbling of the bowels, and diarrhœa. In some cases there is an increased discharge of urine. Gaitshell, who soon afterwards repeated these experiments,[3] obtained no such results. He only produced a copious eruption of pustules which he was the first to describe as an effect of tartar emetic. The last observation was confirmed by Bradley, in 1793,[4] who, however, denied that the solution produced even general diaphoresis. Hutchinson, on the other hand,[5] in 1795, corroborated in the main Sherwen's results ; and the later experiments of Gendrin, who saw violent vomiting and purging in four cases produced by frictions with tartar emetic ointment made by mixing a solution of the salt with lard ; of Lembert, who observed, in addition, general sweating and diuresis ; of Bertini, who noticed violent colic and diarrhœa produced by a pitch plaster with tartar emetic applied to the abdomen ;[6] and of Strambio, who observed slow pulse, pallor, coldness, vertigo, faintness, and debility,[7] from the same cause ; all of these, and other examples that might be cited, prove that a frequent consequence of applying tartar emetic to the skin is derangement of the stomach and bowels, with diaphoresis and depression of the whole system.

The local effects of the application are the following : A superficial and slight redness is almost the only effect of the watery solution ; but when the medicine is retained in contact with the skin by being mixed with fat or some adhesive substance, it at first produces redness, and afterwards pustules which closely resemble those of smallpox, like which they form scabs, and may leave indelible scars behind them. This eruption is usually mature on the fourth or fifth day from its first appearance.[8] Sometimes, in consequence of the delicacy or the diseased state of the skin, or the quantity of the salt applied, large and deep sloughs are produced, and create a permanent deformity. They may even produce a fatal effect. Neumann[9] saw caries of the sternum and of the vertebræ from the use of this ointment in the treatment of whooping-cough.

[1] Annuaire de Thérap., 1864, p. 148.
[2] Memoirs of Lond. Med. Soc., ii. 390.
[3] Ibid., iv. 79.
[4] Ibid., p. 247
[5] Memoirs of Lond. Med. Soc., v. 81.
[6] DIERBACH, Neueste Entdeckungen, iii. 373.
[7] GIACOMINI, op. cit. p. 262.
[8] WIBMER, Wirkung, etc.
[9] Heilmittellehre, p. 521.

A similar result has been witnessed when it was used to recall a suppressed eruption of tinea.[1] These untoward effects seem most likely to occur when tartar emetic is applied upon plasters.

The operation of tartar emetic upon the skin is by no neans uniform. In some persons this tissue is very insensible to its action, while in others it appears to be morbidly susceptible. A similar difference is observed in the absorbent powers of the skin. As a general rule, pustulation is said to be produced with difficulty in cases of visceral inflammation of a high grade, and in fevers of the same class; yet, according to some authorities, the system becomes readily affected under the same circumstances. But when the febrile state declines, the skin regains its susceptibility, and a characteristic eruption appears upon the parts where the frictions were made.[2] Many writers have reported that the application of tartar emetic ointment upon the part has been followed by a crop of pustules upon another and often distant region of the body. But when the cases which they cite are examined, it is at once perceived that the seat of the supposed secondary eruption is always a very delicate portion of the skin, and just such a one as would be apt to have the ointment carried to it by the patient's hands from the parts first rubbed. Such parts are the lips, the nostrils, the genital organs, the anus, etc.

The absorption of this medicine by the tissues, and its circulation through the system, may be further illustrated by one or two examples. A dose of tartar emetic was administered to a nursing-woman suffering from pleurisy; when next the child took the breast it was seized with active vomiting.[3] Orfila,[4] as an ordinary result of his experiments, found traces of antimony in the liver, kidneys, and urine of the animals employed. He also in several instances detected a considerable quantity of this substance in the urine of patients who had been taking large doses of it.

The experiments of Lieberkühn, Fontana, Magendie, Dupuy, and others, show that even when a solution of tartar emetic is *injected into the veins*, its principal effects are manifested in the stomach. Several cases are collected by Wibmer,[5] in which this method was employed to cause the expulsion of foreign bodies lodged in the œsophagus. From these examples it would appear that the promptness of the effect was not in proportion to the quantity of tartar emetic employed. Thus, in four cases the quantities injected were severally six, four, three, and two grains, but the periods at which vomiting commenced were respectively thirty, one, fifteen, and fifteen minutes. Given by *enema* this medicine purges, and sometimes vomits also.

Internally. Small Doses.—Mayerhoffer, who seems to have conducted his experiments carefully, asserts that the repeated use of even so small a dose as the one-hundredth of a grain occasioned a

[1] Bull. de Thérap., vii. 342.
[2] Guérin and Duparcque, Bull. de Thérap., xlii. 49.
[3] Wibmer, Wirkung, etc.
[4] Toxicologie, i. 618.
[5] Op. cit., v. 180.

sensible derangement of the functions, which, however, became more distinct as the dose approached one grain.[1] When the quantity was gradually augmented until an emetic dose was reached, the following effects were observed: The malaise and nausea, which had before existed, increased, with frequent eructation, and retching followed by vomiting; the stools were frothy, and consisted of mucus and bile; the abdomen was distended and painful; the urine, which at first had been copious, became scanty; the region of the liver was tender upon pressure; rumbling and cooing sounds proceeded from the abdomen, which was the seat of tearing, cutting, and griping pains; there were pains also in the lower limbs. There was an increased sense of warmth, alternating with chilliness, over the whole body, and the skin itched. Anorexia was complete, and if any food was taken, it renewed the nausea. The throat felt raw, and deglutition was somewhat difficult and painful. The tongue was covered with dirty mucus, and there was a pasty and insipid taste in the mouth. A sense of fulness was perceived in the chest, and the head felt heavy, dull, and oppressed. There was also a transient but irritating pustular eruption of the skin. The same fact is stated by Lohmier,[2] who also mentions pain in the genitals and total impotency among the symptoms. The proportion of fibrin in the blood is also diminished. Dr. A. Nobiling, of Munich[3] who made experiments upon himself and upon the lower animals with hypodermic injections of minute doses of this substance, arrived at the conclusion that there are two independent modes of action in tartar emetic, one on the heart and the other on the digestive canal; that the former of these is due to "the potash which exercises a direct paralyzing action on the heart," and the other to the antimony alone. This singular and improbable judgment does not appear to have been confirmed.

When the dose is large enough to produce vomiting, various general symptoms precede, accompany, and follow this act. Such are a copious secretion of mucus and saliva in the mouth; eructation of a watery fluid with an acrid and saline taste; watery stools, preceded by colic; pain in moving the tongue; pallor and collapse of the features; often cold sweat, especially of the forehead; dizziness, and not unfrequently scintillation before the eyes; general exhaustion, debility, and an inclination to repose and sleep; a weak, small, and sometimes infrequent pulse; often palpitation of the heart, and sometimes a disposition to syncope. In some cases the face is hot, while the rest of the body is chilly. The act of vomiting is often accompanied by laborious and incessant straining and retching, which sometimes continue long after the complete evacuation of the stomach, and produce extreme relaxation and exhaustion. It may here be noticed that a dose of tartar emetic, such as usually excites vomiting when given with a small quantity

[1] BÖCKER, Beiträge zur Heilkunde (Crefeld, 1849), ii. 372.
[2] Lancet, March, 1846, pp. 361, 362.
[3] Brit. and For. Med.-Chir. Rev., April, 1869, p. 513.

of water, will, on the other hand, occasion purging without vomiting if largely diluted. The matters vomited consist mainly of mucus and bile, which are sometimes mixed with blood. After the vomiting is over, a disinclination for food and a strong craving for cool drinks remain. The action of tartar emetic on the pulse, which does not appear to have been observed in the experiments which have been described, was particularly studied by Ackermann. His observations were made on healthy persons, and the dose of the medicine administered to them was three-quarters of a grain. He uniformly found that the pulse became quicker, smaller, and weaker, and in proportion to the degree of nausea which was produced.[1] He also observed[2] that the rate of the pulse increases with the development of the phenomena of collapse, and that these are not effects of the vomiting and purging which may occur, for they subside and reaction sets in when once the evacuations have commenced. But it never begins while the nausea lasts. The prostration and tendency to collapse appear to be the result of the impression made through the nervous system upon the circulation, and *vice versa*, for they are strictly analogous with the phenomena occasioned by fear and other depressing emotions as well as by the movements of a swing or a ship, or again, by loss of blood, etc.

The influence of diet in modifying the operation of tartar emetic ought not to be overlooked. In the treatment of certain chronic and non-febrile affections, Trousseau found that constitutional effects such as have been described, were manifested only so long as the patients were kept upon low diet. Whenever food was more abundant and substantial, the local disturbance was augmented.[3] He observed, further, that certain articles of food and certain medicines modified the antimonial operation. Wine and acidulous fruits, both fresh and preserved, developed in a remarkable degree the emetic and purgative properties of the medicine, a fact which the writer explains by saying that tartaric and citric acids form soluble and violently emetic salts with antimony.

Large Doses.—The quantity of tartar emetic which may be considered poisonous is uncertain. Recovery has taken place after the ingestion of 120 grains of this substance, and, on the other hand, several fatal cases are recorded, occurring in children, where ten grains, or less of it, have been taken. In several of these cases, the poisonous dose did not exceed a quarter of a grain, but the patients were already weakened by disease.[4] Merei, of Pesth, met with several cases of death in children from profuse diarrhœa provoked by tartar emetic. The patients did not vomit, but had twenty or thirty stools in rapid succession, followed by fatal collapse.[5] The writer has known a dose of not more than half a grain produce violent vomiting and purging, and a state closely resembling the

[1] Brit. and For. Med.-Chir. Rev., April, 1859, p. 346.
[2] VIRCHOW'S Arch., xxv. 531.
[3] Mat. Med. et Thérapeutique, ii. 731.
[4] BECK, Infant Therapeutics, p. 35.
[5] Month. Journ. of Med. Sci., Oct. 1850, p. 368.

collapse of cholera. The patient was an insane female, whose general health, however, was perfect. There is a case on record in which two grains given to an adult, proved fatal after producing violent symptoms. The patient would seem to have been laboring under functional dyspepsia produced by mental causes. No lesion of the stomach was found after death.[1] A case is also recorded[2] in which repeated doses of a solution of this substance given to a robust child three years of age, for the relief of asthma, produced hyper-emesis and catharsis, collapse and death. Two fatal cases in children in which three-quarters of a grain was the dose taken, are reported by Mr. Wilton.[3] Three cases are related by Hulot, in which three grains, one grain, and two grains were the quantities given. But although taken in divided doses, such violent symptoms and extreme prostration followed as rendered death imminent.[4] In a case related by Dr. Pollock, and which occurred in Italy, a native of that country, robust, and in full health, was destroyed by sixty grains of tartar emetic.[5]

The phenomena of poisoning by tartar emetic may be described as follows: The patient is attacked with pain in the stomach, followed by incessant retching, præcordial cramps and burning heat, distension of the epigastrium, severe colic, watery and frequent stools, dryness of the throat, difficult deglutition, an unpleasant metallic taste in the mouth, and sometimes a copious discharge of saliva. The muscles of the neck, jaws, abdomen, and extremities are more or less rigid;[6] and sometimes there is active delirium. Generally the skin is pale and cool, and covered with a clammy perspiration; there is complete prostration of the strength, and sometimes repeated fainting or prolonged insensibility; the pulse is small, weak, contracted, and after being at first infrequent, falling, perhaps, to thirty-four in the minute, it afterwards becomes rapid, thready, and almost imperceptible. In this condition death may take place. The frequency of respiration is generally diminished, and may be reduced to five or six in a minute. Even where recovery ultimately ensues, the rate of the breathing, and of the pulse also, may continue to be slow for several days. Although such effects as have been described do really take place, it is, at the same time, true that they are exceptional, and that much larger doses of the medicine than produced them have often been given, not only without mischief, but with great advantage.

There are instances in which enormous doses of this preparation have been taken without a fatal effect. In one of these half an ounce of it was swallowed by mistake for Epsom salts,[7] and neither in it nor in Dr. Pollock's case was there any purging. In another, in which nearly an ounce was taken, extreme prostration was the

[1] Archives Gén., xxvi. 262. [2] Boston Med. and Surg. Journ., 1849.
[3] Taylor, on Poisons, 2d Am. ed., p. 476.
[4] Archives Gén., 5ème sér., i. 474. [5] Lond. Med. Gaz., May, 1850, p. 801.
[6] Two instances of Tetanic Symptoms caused by Antimony. By Dr. Elliotson, Times and Gaz., July, 1856, p. 6.
[7] Lancet, May, 1847, p. 535.

first symptom, and in two hours violent purging, with vomiting, thirst, and a burning pain in the fauces, gullet, and stomach. There was also, on the third day, a copious eruption of tartar emetic pustules over the whole body. This is the only example known of such an occurrence.[1] A somewhat similar effect, the production of a papular eruption, resembling roseola or rubeola, and which lasted but a few hours, has been also described.[2]

Tolerance.—This singular property of tartar emetic remains to be noticed. When a large dose of the medicine is repeated at intervals, it ceases to produce evacuations. Its action seems then to be wholly antiphlogistic, sedative, or, as it was called by the discoverer of this fact, *contro-stimulant.* In 1811, Rasori, to whom the discovery is due, published his celebrated essay on the treatment of pneumonia by tartar emetic.[3] In this essay he claims it as new, and admits it to be opposed to received opinions, "to conduct the treatment of pneumonia with tartar emetic from the onset to the close of the attack, to make it the chief, and often the sole remedy, to carry its dose far beyond what the boldest practice had ever before reached, by administering a scruple, a drachm, or even several drachms in the course of twenty-four hours, and not uncommonly several ounces in the course of an attack, and finally, with all this, not to bring on vomiting and purging, or, at least, but slightly and rarely, nor to excite perspiration beyond what is appropriate to the nature and the stage of the disease." It was Rasori's belief that tolerance of the medicine in large doses depends upon the inflammation present, and ceases with this condition. But experience has not confirmed his opinion. On the contrary, Laennec remarks: "Every day I observe tolerance indefinitely prolonged in the case of patients who have recovered their appetite and strength. . . . . It is true that after the acute stage of a pneumonia tolerance diminishes and sometimes ceases altogether, but it is more usual for the patient to become accustomed to the tartar emetic, and to such a degree that during convalescence, and when he has grown able to eat as much as a healthy person, he will still take daily, and without knowing it, six, nine, twelve, and even eighteen grains of the medicine."[4] On the whole, Laennec concluded that the habit of taking the medicine, and not the presence of an inflammation, is the cause of its being tolerated. Subsequent observers have amply confirmed this view. Dance remarked that if the medicine was suspended and afterwards resumed, it excited vomiting and purging until tolerance was established anew. It would seem that, as Bonamy suggests,[5] the gastro-intestinal mucous membrane ceases by degrees to respond to the impression of the medicine, having been rendered by it obtuse to the action of all stimulants; hence,

[1] TAYLOR, op. cit., from Med. Times, and Western Journ. of Med. and Surg.
[2] Bull. de Thérap., lxxiii. 35.
[3] Delle Peripneumonie inflammatorie e del curarle principalmente col Tartaro Stibiato. Opuscoli di Med. Clin., ii. 129.
[4] Traité de l'Auscultation, 4ème éd., i. 621.
[5] Etudes sur les Effets Physiologiques et Thérapeutiques du Tartre Stibié, p. 124.

obstinate constipation generally results from its use. When tolerance is established with difficulty, it is generally of short duration, and if then the use of the medicine be persisted in, derangement of the stomach and bowels supervenes.[1] In such cases it is probable that it produces its specific inflammation of the gastro-intestinal mucous membrane (presently to be described), which, causing the tartar emetic to be rejected from the system, prevents the establishment of its proper sedative action. Tolerance is not easily established, nor does it last long, in females and children. In the latter class of patients its duration is peculiarly brief, and is apt to be followed by exhausting discharges.

Local Effects of Large Doses.—A burning sensation with constriction is felt in the pharynx and œsophagus, with swelling, dryness, heat, and redness of the posterior fauces; there is difficult deglutition and a disagreeable metallic taste; later, upon the half arches, the velum, the pharynx, the edges of the tongue, and the cheeks, ulcers make their appearance. They are generally one or two lines, but sometimes half an inch, in diameter, except upon the dorsum of the tongue, where they are generally linear, and are covered with a deposit resembling false membrane. This peculiar inflammation sometimes extends to the soft palate, tonsils, and pharynx. Boudet observed this condition in twenty-six out of a hundred and forty-four cases of pneumonia treated with tartar emetic, and in only five of these was the upper portion of the air passages completely unaffected.[2] In certain cases a pustular eruption is developed in the mouth and pharynx having the general characters of aphthæ, but in some it is identical with that produced by tartar emetic upon the skin. It is said to appear about the fourth or fifth day of the treatment, and, according to some writers, in nine-tenths of the cases in which this agent is given in large doses.

Internal Lesions.—Hoffmann relates a fatal case of poisoning by tartar emetic in which sphacelus of the stomach and of several adjacent organs was found after death.[3] This statement wants confirmation. In a case reported by Recamier, the peritoneum was injected, the mucous membrane of the stomach tumid, red, and covered with tenacious mucus. In addition to these alterations may be mentioned softening of the gastric mucous membrane, with hypertrophy and ulceration of the muciparous follicles of the stomach and the lower portion of the œsophagus. Engel describes ulceration both of the agminated and of the solitary intestinal glands, or rather of the mucous membrane covering them. Durand-Fardel reports a case in which a pseudo-membranous exudation covering the whole pharynx and œsophagus was found.[4] None of these lesions occur frequently; all of them, indeed, may be regarded as exceptional, since several writers who have had large experience in the use of tartar emetic have failed to meet with

[1] TROUSSEAU and PIDOUX, op. cit., ii. 729.
[2] CANSTATT's Jahresbericht, f. 1853.
[3] ORFILA, Toxicologie, i. 624.
[4] Bull. de Thérap., xxv. 370.

them. It is, indeed, denied by some, however groundlessly, that they are the effects of antimonial irritation. Strambio published an account of his dissections in twenty-four fatal cases of pneumonia which had been treated with antimony after the Rasorian method, yet no trace of its action was found in the intestinal canal.

It is of interest to note the effects of the long-continued use of small doses of this substance. They have been studied by experiments upon animals and clinically, or in the investigation of cases of homicidal poisoning, by Millon and Lavran,[1] Dr. Nevins,[2] Dr. Taylor,[3] and others. The principal symptoms of chronic antimonial poison are great nausea, vomiting of mucous and bilious liquids, great depression, watery purging, followed often by constipation of the bowels, a small, contracted, and frequent pulse, loss of voice and muscular strength, coldness of the skin, with clammy perspiration, and death from complete exhaustion.

After this review of the effects produced by tartar emetic upon the animal economy according to its dose, mode of administration, etc., it would not be difficult, in imitation of many eminent writers upon medicines, to defend a theory of its *modus operandi*. But, notwithstanding all that is known and all that is surmised upon the subject, the question remains as obscure, as insoluble, perhaps, as any in therapeutics. One thing alone is certain; tartar emetic does not produce vomiting by an irritant action upon the stomach merely. Introduced by the bowels, the skin, or the veins, its action is essentially the same. The doctrine that it acts through the nervous system is nothing more than a hypothesis, which may, indeed, serve as a conventional expression to mark the limits of our knowledge, but which conveys no sensible idea of a definite fact.

Uses.—Although it is customary to treat separately of the emetic and the sedative properties and uses of the preparation under notice, no such natural distinction, it is believed, exists in regard to moderate doses; the two are generally united, and, where this is not the case, the one is an ordinary effect of the other. We shall, therefore, point out under each disease in which the medicine is used the mode by which its curative effects are obtained.

Fevers.—The use of tartar emetic in *typhus* was recommended by Rasori. Richter[4] considered it appropriate to almost all conditions of the system which occur in fever, to the typhoid no less than the inflammatory, the mucous, the bilious, and the rheumatic forms, particularly at the commencement of the attack. It is an ancient and well-approved practice to give an emetic at the outset of a febrile disease, and, provided that it be done betimes, the subsequent course of the attack is generally milder and shorter. But except in robust subjects, other emetics than the one under notice are to be preferred. It is also used as a sedative and diaphoretic

[1] Annales d'Hygiène, xxxvi. 221.
[2] Liverpool Med.-Chir. Journ., i. 36.
[3] Guy's Hospital Reports, 3d ser., iii. 369.
[4] Ausfürlich. Arzneim., v. 182.

through the course of the attack, as well to moderate the general febrile movement as to meet special indications. A very important one is described by Blane[1] as follows: "The head being particularly affected in this sort of fever [typhus], the patient is extremely restless and delirious, especially at night; and there is a medicine which has a most pleasing effect in procuring both rest and perspiration. This is a combination of an opiate with an antimonial medicine, which was administered in the evening with great success." Almost exactly the same indications are furnished by Graves;[2] he advises this combination in the class of cases of typhus in which, at an advanced stage of the attack, there is cerebral excitement, and determination to the head, with total want of sleep, persistent delirium sometimes of a furious kind, etc. A quarter of a grain of tartar emetic given every hour until the excitement subsides, and after this an opiate medicine, seem to dissipate the alarming symptoms, and pave the way to recovery. These cases are certainly exceptional in the history of petechial typhus, so much so that there is reason to suspect that in those referred to by Dr. Graves some cerebral complication must have existed, for, as a general rule, the disease is, of all others, the most intolerant of sedative medicines. *Eruptive fevers* call for great caution in the use of this remedy; indeed, the safer rule would probably be to exclude it altogether from their treatment. If, at any time, they are judged to require the use of an emetic, one of a stimulating sort would be preferable. It is comparatively an old method to prescribe tartar emetic before the commencement of the treatment by bark and its preparations in *intermittent fever*. But certain modern writers have recommended it in doses large enough to produce tolerance by their repetition, and claim to have found the method a successful one. That it may sometimes have cut short the disease by a profound and violent agitation of the whole economy, and in this way have prevented a recurrence of the paroxysm, must be admitted, since the same result has followed the employment of many remedies which have certainly no antiperiodic virtues. But the emetic plan has repeatedly failed altogether, and cannot deserve much regard when remedies of so much greater efficacy are within reach. But when, as often happens, the attack is preceded by gastric derangement, sallowness of the skin, and an icterode tinge of the eye, emesis is the best introduction to a cure; but even under these circumstances a vegetable is preferable to an antimonial emetic. Vernal intermittent fever may sometimes be cured by such emetics alone.

Pneumonia.—The treatment of this disease by tartar emetic was used in Great Britain by Balfour about the year 1818.[3] In this

[1] Diseases of Seamen, p. 367. [2] Clinical Medicine, p. 128 et seq.

[3] He regarded the medicine as to a great extent a substitute for depletion, alleging that in many cases of local inflammation "a speedy and perfect cure can be obtained with the loss of so moderate a quantity of blood as to warrant the conclusion that bleeding might be safely omitted altogether, even in circumstances in which it is generally considered the only means of saving the patient's life."—*Illustrations of the Power of Emetic Tartar*, p. 8.

country it was used by Dr. McCall, of Tennessee, in 1821; but it does not seem either at that time, or subsequently, to have attracted much attention from American practitioners. In England, too, the method was adopted tardily, and with great hesitation, and even after Mackintosh and Dr. Stokes had written in its favor, it continued by the greater number to be regarded with suspicion. Dr. Stokes, even, did not depend upon it exclusively, but always considered it as secondary to general and local bleeding. He saw correctly that it was more effectual before than after hepatization is complete; but he confirmed the Rasorian doctrine to the extent of showing that although the first doses of the medicine produce vomiting and purging, these effects generally subside after twenty-four hours, when, as he remarked, might be witnessed the interesting circumstance of a patient taking from eight to twelve grains of the remedy daily without vomiting, purging, or sweating, or, indeed, any effect save the gradual removal of the pneumonia.[1] Dr. Stokes prescribed the medicine in doses such as were recommended by Laennec, and in this respect, as well as in this estimate of its efficacy, Dr. Williams agreed with both of the physicians named.[2] Dr. Copland,[3] and Dr. Davies,[4] who employed it in a very methodical manner, but in smaller doses at first than were needful, Dr. Blakiston,[5] and Dr. Walshe, who declares that if he were forced to surrender either cupping and tartar emetic or general bleeding, in the treatment of pneumonia, he should not hesitate to relinquish the last,[6] are the principal English authorities, in addition to those before mentioned, who advocate the use of tartar emetic in the treatment of pneumonia. But none of them has given such detailed accounts of its effects as will enable us to determine its precise value either as compared with other remedies, or with a purely expectant treatment. This has been done in a very satisfactory manner by M. Grisolle in his classical work upon pneumonia,[7] and from it we must mainly draw the materials for a definite and rational judgment of the case.

It was shown by Rasori, 1. That pneumonia may be treated throughout its entire course by tartar emetic; 2. That the cure may be confided to it chiefly or alone; 3. That by its use depletion may be greatly lessened or entirely dispensed with; 4. That it may be given in what seem enormous doses, as twenty-four grains in as many hours, or two ounces in the course of the attack; 5. That these doses produce neither vomiting nor purging, nor any serious disturbance of the digestive organs, but a state of *tolerance* which has already been described.

When we come to estimate the value of the Rasorian method, we find that it did not consist of the use of tartar emetic only, but

[1] Diseases of the Chest, p. 345. [2] Cyclopædia of Pract. Med., iii. 440.
[3] Dictionary of Pract. Med. (Am. ed.), ii. 894.
[4] WATSON'S Lectures (Am. ed.), p. 513.
[5] On Diseases of the Chest, p. 280.
[6] On Diseases of the Lungs, etc. (Am. ed.), p. 302.
[7] Traité Pratique de la Pneumonie aux différens ages, etc. Paris, 1841.

that copious depletion was generally employed along with it, so copious, indeed, that no honorable and successful practitioner has since ventured to imitate its excesses. The doses advocated by Rasori were never generally adopted by other physicians, and by a few only in Italy, where Tommasini, in particular, inculcated a less heroic plan. He usually commenced the treatment with six or eight grains a day of tartar emetic, in divided doses, and rarely exceeded fourteen grains in this period. Laennec employed a very analogous system. He prescribed one grain of the medicine every two hours, until six grains had been taken; and then, unless the symptoms were urgent, allowed the patient to repose for seven or eight hours. By gradually augmenting the dose, he sometimes reached the quantity of thirty grains in twenty-four hours. In this manner, and taking into the account well-marked cases only, he lost but about one patient in twenty. Louis, who investigated this subject with his wonted discrimination and impartiality, found that of twenty cases in which the disease presented a grave type, three only were fatal, and these were of persons between sixty and seventy years of age. Trousseau lost but two out of fifty-eight cases which he treated almost exclusively by antimonial preparations.

But the most conclusive facts which bear upon this subject consist of a group of cases, forty-four in number, which Grisolle treated by means of tartar emetic alone. They were all of a grave type. The treatment was commenced between the second and the ninth day of the disease. The initial daily dose of the medicine was from six to eight grains dissolved in five ounces of a simple infusion, and administered in portions every hour. The greater number of the patients did not take more than twenty grains in the course of the attack; some of them, however, took as much as sixty grains. All, without exception, experienced from it certain primary effects—vomiting and purging, namely; but the latter was the more frequent of the two. Out of sixty-six cases in which the medicine was continued for several days, tolerance was manifested in seventeen after the third or fourth day; and among one hundred and fifty-four patients who took the medicine in the manner described, twelve only tolerated it from the first.

Its influence upon the individual symptoms may thus be expressed. The first sign of its beneficial operation is the diminution or the cessation of the *stitch* in the side. Within twenty-four hours after the first dose the pulse falls considerably, and becomes softer, and at the same time the heat of skin abates. The fall of the *pulse* in the period mentioned varies between ten and forty beats a minute. The frequency of the *respiration* also declines, and most so when it has previously been most hurried. In seventeen of thirty-three cases the *sputa*, which were highly characteristic when the first doses of the medicine were taken, lost the greater part of their pneumonic characters within twenty-four hours, and in one-third of the cases had assumed the appearance of catarrhal sputa. In nearly all the *physical signs* furnished by auscultation and percus-

sion began to diminish after the first day's use of the medicine. The *other symptoms*, such as headache, thirst, general malaise, etc., declined or ceased for the same period. As Trousseau has remarked, one effect of this treatment is that there is hardly any convalescence. Three days are sometimes sufficient to transport a patient from the very brink of the grave into such a state of well-being that, were it not for the auscultatory signs, the fact that he had labored under a dangerous attack of pneumonia would be incredible. Grisolle confirms this statement, and adds that he has been surprised how rapidly the strength returns in such cases. The fact that it had not been consumed by depletion or prolonged sickness will probably suffice to explain this striking result. The appetite, too, is speedily restored, and so completely that sometimes in forty-eight, or even twenty-four, hours after taking the first potion the patients have urgently asked for food. As will be inferred from these facts the average duration of the attack is remarkably short; in the series of cases referred to it did not exceed ten days, and out of forty-four patients twenty were able to resume laborious occupations on the twentieth day from the commencement of the attack. The rapidity of the cure did not appear to bear any proportion to the number of discharges by the mouth and bowels. In comparing this group of cases with one in which tartar emetic and depletion were conjoined, the proportionate mortality in the latter appears to be less than in the former, but the duration of the attack greater. These were cases in which the strength of the pulse and the general febrile excitement appeared to call for venesection.

Although some authors recommend tartar emetic in the *pneumonia of children*, the propriety of its use is open to serious question. The dangers to which it exposes persons of tender age have already been pointed out. They would of themselves go far to inspire extreme caution in employing the medicine for the class of patients referred to, as well as for those whose delicacy of constitution, or whose impaired strength contraindicates the use of direct sedatives. Before the end of the second year of life this medicine ought seldom, if ever, to be prescribed, but subsequently to this period it may sometimes be useful. In children at the breast, Valleix did not derive advantage from it in the treatment of pneumonia,[1] and Bouchut depicts the state of collapse he has known it to produce;[2] Rilliet and Barthez,[3] it is true, found its effects almost identical with those which have been described as occurring in adults, but they speak of the readiness with which it deranges the stomach and bowels, and even produces softening of the gastro-intestinal mucous membrane, when the pneumonia is secondary.[4] They, however, hold it to be useful when prudently employed. Hérard[5] prescribed it successfully in the Children's Hospital at Paris, since

[1] Clinique Méd. des Enfans, p. 179.
[2] Malad. des Nouveaux Nés, p. 342.
[3] Malad. des Enfans, i. 118.
[4] Ibid., p. 468.
[5] RANKING'S Abstract, vii. 47.

he lost but five out of twenty-nine cases of primary pneumonia. Dr. West[1] also regards it as serviceable, but is by no means disposed to rely upon it to the exclusion of depletion and mercurials. Dr. J. F. Meigs,[2] while admitting the usefulness of extremely small doses of the medicine as an antiphlogistic, rejects it as hazardous when given in such quantities as were used by the writers just quoted. He found that in some cases such large doses of it caused a more or less persistent paleness, exhaustion, and rapidity and weakness of the pulse, attended sometimes with drowsiness alternating with irritability, and depending apparently upon prostration.

As regards the *dose* which may be given to children, Dr. West advised that for children two years old, one-eighth of a grain should be administered in solution every ten minutes until vomiting is produced, and continued every hour or two afterwards for a period of from twenty-four to thirty-six hours. Rilliet and Barthez give very similar directions.

Contraindications.—Many physicians have objected to the use of large doses of tartar emetic in pneumonia, that sometimes it occasions inflammations of the bowels. Both Laennec and Grisolle, however, found that redness of the tongue, abdominal pain increased by pressure, copious evacuations, etc., are mitigated rather than aggravated by continuing the medicine, provided that these symptoms have been produced by the action of the medicine itself. If they depend upon previous gastro-enteric inflammation, or if any degree of this state exists, the use of tartar emetic is wholly inadmissible. Hence, in the treatment of tuberculous pneumonia, the probability is so great of the bowels being already diseased, that the use of tartar emetic would be extremely hazardous.

Laennec held that when the medicine is not tolerated it ought to be abandoned; but since it is certain that its efficacy does not depend upon this condition any more than it does upon the evacuations which it may produce, a juster rule would be to persist in its use provided the local and general symptoms of the disease are improved by it. It should not be forgotten that complete toleration of the medicine from the first is unpropitious rather than encouraging, for it betrays a feeble and imperfect power of reaction.

Dr. Peebles, of Petersburg, Va., has described injurious effects which he attributes to this medicine employed in the treatment of pneumonia.[3] The chief symptom it seemed to produce was hemorrhage from the nostrils or from the bowels. Of the cases which he relates one only presented characteristic pneumonic symptoms, and in that one the "anxious and shrunken countenance, cold, harsh skin, and feeble pulse," did not certainly render tartar emetic a seasonable remedy. A tendency to hemorrhage is not one of the toxical effects of tartar emetic, at least in the white races, and in the cases referred to it must be attributed to a different cause.

Attention has been called to another mischievous effect by Dr.

[1] Lectures on the Diseases of Infancy and Childhood (Am. ed.), p. 199.
[2] Diseases of Children, 2d ed., pp. 169, 170.
[3] Am. Journ. of Med. Sci., April, 1848, p. 338.

Boling.[1] It resembles somewhat the usual poisonous effects of the medicine, but is ascribed by Dr. Boling to the use of calomel along with the tartar emetic. While the improvement appears to be progressive under the treatment, "suddenly, in some cases, in others, somewhat gradually, the patient becomes restless, the thirst is augmented, the discharges from the bowels are more numerous and thin, the abdomen becomes tympanitic, and perhaps tender, the tolerance is lost, and though he may not have done so for several days, he vomits, or makes frequent efforts to do so; the tongue becomes dry and pointed; there is jactitation, anxiety of countenance, delirium, and perhaps stupor a short time before death. Occasionally jaundice supervenes, and in a few cases the matter vomited bears a close resemblance to that ejected in yellow fever. During the progress of the change, the pulse becomes more frequent, hard, concentrated, small, and thready." Such symptoms resemble more closely, it is true, than those of Dr. Peebles' do, the ordinary toxical effects of emetic tartar, yet are not identical with them. We are, therefore, disposed to entertain Dr. Boling's suggestion, and suspect that they may be attributed to the simultaneous administration of mercurial and antimonial medicines. If this notion be well founded, it inculcates an important lesson, particularly for practitioners of the Anglo American school who attach so much value to the use of mercurials in all inflammatory affections.

Pregnancy is generally regarded as a contraindication to the use of large doses of tartar emetic. But Grisolle called this judgment in question. The violent vomiting which is an ordinary symptom of pregnancy, does not, as a general rule, increase the chances of miscarriage. Now, although it is true that this accident is only occasionally provoked by the sympathetic vomiting of pregnancy, and although Grisolle saw no case in which it could clearly be attributed to the emetic medicine, it does, nevertheless, seem to be a physician's duty to avoid even this inconsiderable danger, unless the antimonial treatment is essential to save the mother's life. That depletion exposes to a still greater danger is perhaps not a perfectly satisfactory reason for incurring the lesser one.

Pseudo-membranous Laryngitis. Croup.—In this disease the tartrate of antimony and potassium is recommended as an emetic, and as a sedative antiphlogistic remedy at the same time. The concurrent use of general depletion and mercurials, with which its operation is believed to harmonize, is generally prescribed. But while the employment of emetics in such a conjunction cannot be too strongly insisted upon, it is equally important that the patient's strength, which the disease itself tends only too rapidly to undermine, should not be exhausted by so depressing an agent as the one in question. Plastic exudation cannot be cured by sedatives of the circulation and debilitants. These medicines tend to hurry on the period of fatal exhaustion, when the treatment should rather be so sedulously guarded as to husband the powers of life.

[1] Am. Journ. of Med. Sci., Oct. 1851, p. 330.

Spasmodic Laryngitis.—No medicine is more certainly or more promptly effectual in arresting the progress of this distressing, but seldom dangerous, disease than antimonial emetics. In general, no sooner does vomiting take place under their influence, than the voice and respiration lose more or less of their stridulous character. Emetics which are not also nauseants have a less decided influence than this one, which generally cuts short the attack, when given during its first paroxysm. It relaxes the whole system, and resolves the spasm of the glottis, while it also drains the swollen mucous membrane of the larynx by its sedative action upon the circulation, and permits the air to enter the lungs freely. *Syrupus scillæ compositus*, which is a well-known and universally employed remedy in spasmodic laryngitis, owes its efficacy chiefly, if not entirely, to the tartar emetic which it contains.

According to Trousseau, tartar emetic is very efficacious in arresting *pulmonary hemorrhage* when the source of the discharge is in the parenchyma of the lungs, and not in the bronchia. This distinction seems to be hypothetical. The use, however, of nauseants and emetics to counteract bleeding from the lungs is certainly to be approved when rest, position, and revulsion fail to control it. They were long since recommended by Stoll. In *pleurisy* it was at one time a good deal employed, but a greater familiarity with the natural history of the disease has caused it to be abandoned. *Chronic coughs* depending upon bronchial inflammation have been cured by pustulating the chest with tartar emetic; but other and less painful methods are, at least, as efficient. It has been proposed to administer tartar emetic in acute *phthisis*, and for the cure of the intercurrent inflammations which complicate the chronic form of this disease.[1] In spite of some plausible evidence of its utility, it must be presumed that the statements to that effect are erroneous.

Various writers, of more or less reputation, have reported the results of using large doses of this medicine in *acute articular rheumatism*. The names of Laennec,[2] Chomel,[3] Dance,[4] and, in this country, Findlay,[5] may be alluded to. The results of the first-mentioned authors are far from convincing, for they are sustained by no sufficient evidence. The essay of Dance, which is based upon an analysis of twenty cases, is wholly unfavorable to the remedy. With the exception of a few mild cases, none were permanently or beneficially influenced by it, while the disturbance of the stomach and bowels, and the distress occasioned by the movements it rendered necessary, proved it to be a very ineligible medicine. Chomel found no advantage from its use. The failure of tartar emetic in this disease, and its success in pneumonia, both of them affections which are regarded, but without sufficient reason, as involving the same pathological element, and therefore calling for the same

[1] Bull. de Thér., lix. 49.
[2] Archives Gén., iv. 481.
[3] Leçons de Clinique Médicale, p. 312.
[4] Archives Gén., xix. 415, xx. 5.
[5] N. Am. Med. and Surg. Journ., x. 167.

treatment, illustrate the difficulty and the imprudence of deducing therapeutical precepts from pathological data.

Nauseating doses of tartar emetic have been found useful in a variety of local inflammations. During the forming stage of *tonsillitis*, such or even full emetic doses of the medicine will often cut short the attack. Mr. Lever (1837) and Dr. Kennedy found it a very certain means of arresting the development of *mammary abscess* after parturition. Other physicians have found it equally efficient in *hernia humoralis*, in acute *ophthalmia*, and even in *parotitis*. Recamier and Sanson allege that they have frequently succeeded in suspending the progress of traumatic *phlebitis* by its use in large doses.[1]

Dropsy.—In those forms of the affection to which squill is appropriate, it has been observed that diuresis is more certainly established when tartar emetic is given at the same time. Such are the cases of dropsy which partake of an inflammatory nature, and which have arisen from exposure to cold after an exanthematous affection. If, in such cases, it is thought preferable to employ cathartics rather than diuretics and diaphoretics, this medicine, added to saline laxatives, is believed materially to increase their efficacy. In some instances of effusion consequent upon *pleurisy* or *peritonitis*, emetic doses of the medicine have seemed to promote recovery. Pustulation of the shaven scalp has been recommended in acute as well as chronic forms of *hydrocephalus*.

Hildebrandt and Michaelis both mention having used this medicine successfully in *diabetes*, by giving it in emetic doses, and, in the intervals between them, smaller quantities to promote the cutaneous transpiration.[2] The property which tartar emetic has of increasing the secretion of saliva has already been noticed. On the other hand, we find Dr. Findlay, of Ohio,[3] employing the medicine to arrest *mercurial salivation*. He prescribed from one-tenth to one-sixth of a grain in solution every hour, so as to act upon the skin and intestinal canal slightly, until the cure was complete. In every instance, when thus given, it is said immediately to have checked the progress of the disease, and seldom to have failed within forty-eight hours in removing all complaint of sore mouth or throat. When given in large doses, it has sometimes been known to cause the expulsion of *tænia* from the bowels.

Tartar emetic is useful in several diseases of the *nervous* system. Cases of acute *meningitis* or hydrocephalus have been reported by Laennec, Thomas, and Wolff, and one case of the tuberculous form of the disease by Teallier, in which repeated fractional doses of the medicine appear to have been chiefly instrumental in affecting a cure. But, as remarked by Hahn,[4] it is always contraindicated if the patient is very young, if the meningitis has had prodromic symptoms, and if the inflammatory condition is not well marked.

[1] TROUSSEAU and PIDOUX, op. cit., ii. 740.
[2] DIERBACH, Neueste Entdeck., iii. 448.
[3] N. Am. Med. and Surg. Journ., iii. 194.
[4] De la Méningite Tuberculeuse, p. 171.

On the other hand, it is less objectionable after the age of four years, when the child is not feeble, when the tuberculous diathesis is not fully developed, and the inflammatory symptoms are strongly marked. Neumann relates a case in which severe headache and *amaurosis* followed suppression of an eruption on the left hand and forearm by means of a quack salve. The symptoms were removed by exciting an inflammation on the parts originally affected, by means of tartar-emetic ointment.

Epilepsy and also *chorea* have been cured by pustulation of the scalp and the region of the spine with the same ointment, as well as by the internal administration of tartar emetic. In the latter disease it has been used with advantage as a nauseant and emetic by Bouley,[1] and by Gillette.[2] Similar means have been found effectual in traumatic and idiopathic *tetanus*.[3] At one time the ointment was used extensively as a counter-irritant in *whooping-cough*,[4] but the contradictory estimates of its value even by the best authorities and the extremely painful eruption caused by it, have led to its abandonment. The fact that it sometimes produces caries of the sternum and vertebræ has already been cited from Neumann, who adds, that it seemed to be of no advantage to the cough. The opinion once entertained of its efficacy may be inferred from the statement of Autenrieth, that it cured this disease in fewer days than other remedies would in weeks.

In *mania*, nauseating doses of this medicine are sometimes used to control the violence of the paroxysms; in *melancholia* its emetic operation is occasionally productive of excellent results. But in *puerperal mania*, especially affecting persons of a dull phlegmatic temperament, it was highly recommended by Esquirol. Dr. Evory Kennedy says of it,[5] "In several years' observation of this medicine's application in hospital and private practice, but two or three cases have held out against it when commenced sufficiently early." His plan was to prescribe nauseating doses, under the influence of which the patient was kept for twenty, or for thirty-six hours, or longer if necessary, taking care that depressing effects were not produced. Dr. K. admitted that its use requires great caution. The same author speaks highly of it as an adjuvant to venesection in *puerperal convulsions*, probably in the form depending upon serous plethora. Mr. Spence[6] used it for maniacal attacks in females, especially when connected with disorders of the menstrual function, or occurring after delivery, and during the acute stage of the disease. He gave it according to the contro-stimulant method, in doses varying from five to thirty grains, and found that it seldom occasioned vomiting, but almost always great relaxation of the whole system with general quiescence, and a return to the rational and conscious state. It may serve to show how little the action of the remedy has sometimes been understood, to state that

[1] Bull. de Thérap., liii. 52. [2] Ibid., liv. 242.
[3] DIERBACH, op. cit., from Dublin Journ., Sept. 1842. Bull. de Thérap., lviii. 471.
[4] Archives Gén., ix. 444. [5] Am. Journ. of Med. Sci., xvii. 305.
[6] Edinb. Med. and Surg. Journ., xxxvi. 112.

several writers have recommended it in *delirium tremens*, a disease which presents in the strongest light the frequently occurring combination of excitement with debility. Dr. Peddie, however, advocates its use in this affection, and has published several cases in proof of its virtues.[1] It is possible that the emetic operation of the medicine may have been more serviceable than its sedative and debilitant action was injurious; for the usefulness of *stimulant* emetics in this affection is well established; but it cannot readily be admitted that a depressing agent like the one in question could be of real advantage. In *mania-à-potu*, a condition distinguished by maniacal delirium, and the exertion often of prodigious strength, a fury which, indeed, usually subsides if left to itself, the remedy under notice may be used as a nauseant to control the patient's violence, or to hasten the resolution of the attack. The simultaneous employment of the warm bath with cold affusions upon the head is very serviceable.

To overcome Uterine Rigidity.—In the last century, a surgeon named Lebas, gained great credit among women for the art which he possessed of rendering the process of *labor* easy. According to Velpeau, he employed tartar emetic for this purpose.[2] Ramsbotham recommended nauseating doses of antimony to overcome rigidity of the os uteri. In 1835, Dr. Evory Kennedy pointed out the conditions in which it is useful.[3] In tedious labor from rigidity of the uterus, when the os uteri is found slightly gaping, with a thickened, tense state of the lips, and usually much heat of the parts, he recommended nauseating doses of this medicine as preferable to bleeding, because less exhausting and quite as efficient. He does not, however, assert that it will invariably succeed, it being in some cases unavailing, and in others inadmissible. In 1843, Dr. Gilbert, of Philadelphia, confirmed these statements by his own observations.[4] Favorable reports of its efficacy have also been published by Drs. Young,[5] Channing,[6] Alexander,[7] Read,[8] Storer,[9] Parker,[10] and others. From the reports of these physicians, it may be inferred that the medicine is most useful when rigidity of the os tincæ, or of the perineum, causes the uterus to exhaust itself in unavailing efforts, which are still further neutralized by the agitation of the patient, and her unwillingness or inability to co-operate with the expulsive action of the womb. In such cases tartar emetic, especially if associated with opium, quiets the agitation, mitigates or regulates the violence of the pains, and reduces the action of the uterus within normal limits. In doing so it simply acts in accordance with its mode of operation in all other cases in which it relaxes rigidly contracted muscles; and yet, in place of so simple and palpable an explanation, it has been said that the medicine "excites

[1] Edinb. Month. Journ., June, 1854, p. 506.
[2] Bull. de l'Acad. de Méd., ii. 531.
[3] Am. Journ. of Med. Sci., xvii. 298.
[4] N. Y. Journ. of Med., i. 426.
[5] Edinb Med. Journ., i. 645.
[6] Bost. Med. and Surg. Journ., July, 1856, p. 435.
[7] Ibid., Aug. 1856, p. 55.
[8] Ibid., Jan. 1857, p. 505.
[9] Ibid., March, 1857, p. 122.
[10] Edinb. Med. Journ., viii. 672.

the contractility of the muscular fibres of the uterus, both longitudinal and transverse, favoring at once the dilatation of the neck and the expulsive contractions of the body of the uterus,"[1] an explanation which is scientifically unintelligible, and also in contradiction with the familiar phenomena which the medicine occasions.

Nausea produced by antimony is sometimes successfully employed to favor the reduction of *strangulated hernia*. Without exhausting so much as depletion, it doubtless acts in the same manner, by withdrawing a portion of the blood contained in the vessels of the hernial tumor, and thus diminishing its bulk so much as to render its reduction possible. The same agency is also very efficient in the *reduction of dislocations*, by producing muscular relaxation. The original suggestion of this method is ascribed to Delpech,[2] but a somewhat earlier mention of it was made by Duncan.[3] Injected into the veins, it has been used to procure the expulsion of *foreign bodies* wedged in the œsophagus, as already described in this article. In the same way it has caused restoration from the asphyxia produced by *carbonic acid gas*.

Tartar emetic incorporated with diachylon and formed into a disk has been used to destroy *nævi materni* by causing their pustulation and ulceration,[4] as croton oil had already been applied. Dr. Turner also employed a mixture of tartar emetic and croton oil for the cure of *varicose veins* by applying it to small blistered surfaces in the course of the vessel, and keeping the part at rest in a proper position until the calibre of the vein became reduced by the contraction of the tissues in healing.[5]

Contraindications.—The dangers attending the administration of this medicine to young children have been already dwelt upon; all conditions of the system, at whatever age, which are distinguished by feebleness, render its use hazardous. It is injurious to very old persons, by deranging the digestion and inducing marasmus. In emetic doses it ought not to be given to persons affected with hernia, displacement of the uterus, aneurism, valvular disease or dilatation of the heart, hæmoptysis, or congestion of the brain; during pregnancy it should be very cautiously used, if at all.

Antidotes.—In poisoning by tartar emetic, it is recommended to give large draughts of lukewarm water, followed by infusions of vegetable astringents, such as cinchona, galls, green tea, etc. But the best authorities deny the efficacy of these astringent substances. Berthold recommends strong coffee as the best means of arresting excessive and protracted vomiting produced by this preparation. The Italian physicians generally prescribe wine, alcohol, ether, or opium, for the same purpose.

Administration and Dose.—This substance has an advantage over ipecacuanha in being tasteless, so that it can be administered to children, to the insane, to females, and to others who might

[1] Bull. de Thérap., lxxxi. 342.
[2] Ibid., 1834, vii. 88.
[3] GIACOMINI, from Lond. Med. and Surg. Journ., June, 1833.
[4] Bull. de Thérap., lxii. 41.
[5] Am. Journ. of Med. Sci., April, 1863, p. 382.

refuse a nauseous or unpleasant medicine. To produce *tolerance* of tartar emetic, *one grain* in a small quantity of liquid may be given every two hours until six are taken, and then, after an interval of several hours, the dose may be gradually increased until from fifteen to thirty grains, if necessary, are taken in the space of twenty-four hours.

To excite vomiting, *one grain* is the average dose. It is almost always given in solution. The most convenient plan is to dissolve three grains of the salt in a fluidounce of water, and administer one-half of this quantity; at the end of fifteen minutes half of the remainder, and in fifteen minutes more the rest. Draughts of warm water, or of some weak bitter infusion, may be given as soon as retching begins.

As a *nauseant sudorific* the dose is from a quarter to half a grain, given every hour or more. As a *diaphoretic* and *expectorant*, from one-twelfth to one-sixth of a grain, at intervals of one, two, or three hours. But for such doses *antimonial wine* is preferable. Of this preparation a fluidrachm (or seventy-two drops) contains one-quarter of a grain of tartar emetic.

If thought proper, tartar emetic can be associated with ipecacuanha, in the proportion of one grain of the former to ten or fifteen grains of the latter.

A solution of one grain of tartar emetic and an ounce of Epsom salts in eight ounces of water, and given in wineglassful doses every two or three hours, forms an excellent *purgative* in inflammatory affections.

The *endermic* application of this medicine by means of the ointment has already been described. A saturated solution of the salt in water is considered preferable, as being "milder, less painful, and cleaner" than either the ointment, or the antimonal plaster. It has also been proposed to produce a crop of pustules by inoculation. A paste is made with tartar emetic and a little water or oil, and, by means of a fine lancet, introduced into small punctures in the skin. The pustules which result are touched twice every day with a strong solution of the salt until they reach their maturity. Whenever antimonial ointment is applied to the integument especially in children, great care should be taken to prevent its being conveyed by their fingers to delicate parts of the body, and especially to the eyes and genitals. Serious consequences have followed a neglect of this precaution.[1]

IPECACUANHA.—Ipecacuanha.

Description.—This drug is the dried root of *Cephaëlis Ipecacuanha*, a native plant of the central parts of South America. Its common name is that given to it by the aborigines. In commerce it occurs in pieces of three or four inches long, about the size of a

[1] Bull. de Thérap., liii. 140.

small writing-quill, "variously bent and contorted, simple or branched, consisting of an interior slender, light, straw-colored ligneous cord," and a cortical portion which has "a knotty appearance, in consequence of a number of circular fissures about a line in depth, and which extend inwardly to the central ligneous cord, so as to give the idea of a number of rings strung upon a thread." It has an acrid, aromatic, somewhat bitter taste, and a slightly nauseous but peculiar odor.

The active properties of ipecacuanha chiefly depend upon a principle called *emetia*. In its purest form it is a white pulverulent substance, inodorous, and almost tasteless. When less pure, it has a grayish-yellow color, and is slightly bitter. It is very soluble in alcohol, and but slightly so in water, ether, or oils. It fuses and is readily decomposed at a high temperature. The root also contains a volatile oil in small proportion.

The officinal preparations of ipecacuanha are as follows:—

EXTRACTUM IPECACUANHÆ FLUIDUM.—*Fluid Extract of Ipecacuanha.*

From sixteen troyounces of finely-powdered ipecacuanha three pints of tincture are obtained by percolation. After reduction to a syrupy consistence by distillation the residue is boiled with a fluidounce of acetic acid and ten fluidounces of water until half a pint remains and the resinous matter has subsided. The latter is separated by filtration and its place supplied with water, after which half a pint of alcohol is added.

PULVIS IPECACUANHÆ COMPOSITUS.—*Compound Powder of Ipecacuanha; Dover's Powder.*

This admirable medicine is made by rubbing together of powdered opium and ipecacuanha *sixty grains* each, and of sulphate of potassa *a troyounce*. Ten grains of the powder contain one grain of opium.

SYRUPUS IPECACUANHÆ.—*Syrup of Ipecacuanha.*

It is prepared by mixing two fluidounces of fluid extract of ipecacuanha with thirty fluidounces of syrup.

TROCHISCI IPECACUANHÆ.—*Troches of Ipecacuanha.*

These are prepared with powdered ipecacuanha, sugar, arrowroot, and tragacanth mucilage. Each contains about a quarter of a grain of ipecacuanha. Morphia may be added, in the proportion of one-fortieth of a grain to each troche.

VINUM IPECACUANHÆ.—*Wine of Ipecacuanha.*

This preparation is made by adding two fluidounces of fluid extract of ipecacuanha to thirty ounces of sherry wine, and filtering. *Dose*, as an emetic, for an adult, a fluidounce, for an infant a fluidrachm. As an expectorant from five to thirty minims.

History.—Ipecacuanha was made known in 1649 by Piso, who published an account of its singular efficacy in the dysentery of Brazil. In 1672, a large supply of it was brought from the latter

country to France by a physician named Legros; but it was not until 1686 that it became generally known throughout Europe. Three or four years previously, Adrien Helvetius, after finishing his studies at Leyden, repaired to Paris for the purpose of selling certain nostrums of his father's composition. He failed in his adventure, but made acquaintance with a wealthy druggist, who at that time was under treatment for a serious illness by a physician named Afforty. When the patient got well he presented his physician with some of the Brazilian remedy as a mark of his gratitude; but Afforty, who appears not to have prized the gift very highly, transferred it to Helvetius. The latter made use of it in several cases of dysentery, and was convinced of its possessing specific virtues in this affection. The qualities of the new medicine, whose name, however, was kept secret, were speedily published at all the corners of the streets, and the court and the town echoed with its praises. Luckily for Helvetius, several courtiers, and the dauphin himself, the son of Louis XIV., were treated successfully by means of the new remedy. The king, on learning from his minister, Colbert, how precious a secret Helvetius possessed, deputed his physician, d'Aquin, and his confessor, La Chaise, to ascertain its value, in order that it might be made public. After it had been subjected at Hôtel Dieu to trials, which all issued triumphantly, a thousand louis d'or were paid for the secret of its composition. Meanwhile, a certain Garnier, who had been employed to procure the root from Spain, set up a claim to share the reward upon the ground that the credit of introducing the medicine belonged to himself; but this plea was held to be invalid. Helvetius was afterwards decorated with titles, and raised to the highest medical dignities of France. He wrote a special treatise upon the use of ipecacuanha in diarrhœa and dysentery.[1] It was not, however, until some years afterwards that its value was recognized in Germany by Leibnitz, Valentini, and Wedel, and in England by Sir Hans Sloane and by Baglivi.

Action. *On Animals.*—When ipecacuanha is administered in large doses to dogs it excites vomiting and is followed by depression. *Impure emetia* given to the same animals causes vomiting and depression, followed by sleep and sometimes by death. The mucous membrane of the stomach and bowels, and also of the bronchia, is found to be inflamed. Similar phenomena are occasioned by injecting a solution of emetia into the veins, the pleural or the peritoneal cavity, etc.[2] Two grains of *pure emetia* are said to be sufficient to kill a dog. The experiments of Pecholier upon rabbits, animals that do not vomit, showed that in them the rate of the pulse and of the breathing, the temperature of the body, and the muscular vigor are all very much depressed under the operation of the alkaloid, an ethereal extract, or the powder of the

[1] Compare MURRAY, App. Medic., i. 797; SPRENGEL, Histoire de la Med., v. 468; Biographie Universelle, xx. 23; Biographie Méd., v. 152.
[2] ORFILA, Toxicologie, i. 651.

root. After death the lungs are found pale but the stomach injected. On the other hand Dr. Duckworth[1] declares that in his experiments the respiratory movements were increased in frequency, the cardiac action was not less rapid than in health, and the lungs were engorged with blood. Very probably these opposite results are to be explained by the rapid death of the animals used in the former case, and their gradual death in the latter. Under the poisonous operation of emetia the animal temperature declines.

On Man. Externally.—When powdered ipecacuanha is applied to a portion of the skin deprived of its epidermis, it occasions severe pain and inflammation, and even when incorporated with oil or fat, and used by friction, it is capable of producing severe irritation. At first small papules of a bright rose color make their appearance in great numbers and sometimes confluent, and are followed by small pustules with a central depression, which soon dry and leave no mark behind them. Dr. Turnbull imagined that the pulse was lowered as an effect of this application. The papules cause but little pain. A similar eruption is produced by a plaster of diachylon, or Burgundy pitch, sprinkled with powdered ipecacuanha. The same result is obtained by frictions with the following ointment: ℞.—Pulv. ipecacuanhæ gr. cxx; ol. olivæ f℥ij; adipis ℥ss.—M. Dr. Duckworth, who used a similar application, states that the resulting eruption differs both from that caused by croton oil and by tartar emetic, and that it is not apt to occur upon a part of the skin which had been blistered some weeks previously.

Inhalation.—When dried ipecacuanha root is pulverized in a mortar, the fine particles which become diffused through the air sometimes cause a swelling and inflammation of the eyes and face and irritate the mucous membrane of the respiratory passages, causing epistaxis, sore throat, dyspnœa, and even hæmoptysis. The case is mentioned of an apothecary's wife who, as often as the root was powdered in her husband's shop, was seized with spasmodic asthma.[2] The following case is quoted by Wibmer.[3] A man, while powdering ipecacuanha, removed from his face, during the space of three hours, the veil which he was provided with for his protection. He was seized with vomiting and constriction of the chest, and, after the lapse of an hour, had spasms of the throat and glottis, and his face was of an ashy paleness. Depletion and antispasmodic medicines relieved these symptoms, but in the course of a few hours they returned again, although less violently. For some days afterwards he suffered from fits of dyspnœa. Almost identical symptoms were experienced by H. Bullock from the same cause.[4] The case of Mr. Roberts presents somewhat milder features, but shows an extreme susceptibility to the action of the drug. He experienced dyspnœa and then a regular attack of asthma if he remained in a room where the preparation of ipecacuanha was going on. The attack continued about an hour and ended with copious expectora-

[1] Saint Bartholomew's Hosp. Rep., v. 220.
[2] MURRAY, Apparat. Med., i. 802.
[3] Wirkung, etc., ii. 77.
[4] Lond. Med. Gaz., 1837, p. 701.

tion.[1] Trousseau states that he knew of two apothecaries who were seized with a fit of dyspnœa whenever the bottle of ipecacuanha in their shops was opened. The author is acquainted with a physician who has often suffered from an intense coryza from the emanations of this substance.

Dr. F. Robertson, of Nashville, Tenn., has furnished in his own case a singular example of acquired susceptibility to the action of this drug.[2] Previously to the attacks, which he describes, he had been in the habit of handling and using it without the slightest inconvenience. But once, while putting up a dose of the medicine, he was suddenly and violently attacked with asthma and oppression at the præcordia. He attributed the new susceptibility to weakness produced by fatigue. Two years afterwards a still more violent paroxysm was occasioned by a dose of the wine of ipecacuanha. It was attended with an intense burning sensation in the fauces and in the lungs. After the paroxysms of dyspnœa, and when expectoration became free again, a large quantity of sputa was rejected, "which any person at first sight would have pronounced to be a mass of small nearly transparent worms." These bodies were no doubt formed of concrete mucus moulded in the smaller air-tubes.

Effects of a different kind from any of these were observed in the case of a man who had been pounding ipecacuanha. Along with severe neuralgia in the branches of the fifth nerve, the eyelids were enormously swollen, there was profuse lachrymation, and injection of the conjunctiva; the cornea was turbid, the pupils contracted, and vision completely lost. These symptoms were more marked in the right eye than in the left. Foot-baths, a blister to the nape of the neck, and purgatives, with belladonna ointment around the eye, gradually dissipated the symptoms. On several other occasions the same cause produced similar effects in the subject of this case.[3]

Internally.—In small or nauseating doses, ipecacuanha produces malaise, with shuddering, chilliness, yawning, a flow of saliva, and eructations. In somewhat larger doses it occasionally gives rise to uneasiness and rumbling in the bowels, and a sense of emptiness there, an increased secretion of saliva and mucus, constriction of the chest, irritation of the throat, a dry cough, occasionally spitting of blood or epistaxis, nausea, and an inclination to vomit. Very soon after it is taken in full doses it excites vomiting, which is neither very severe nor frequently repeated, nor attended with the same degree or even kind of sinking and prostration which tartar emetic occasions. In all doses it is apt to relax the bowels, if they are in a healthy state. It differs from the compounds of zinc and copper, in lacking their astringent quality.

The quantity requisite to produce an emetic operation cannot

[1] PEREIRA, Mat. Med., 3d Am. ed., ii. 623.
[2] Amer. Journ. of Med. Sci., Jan. 1844, p. 252.
[3] Journ. f. Pharmakodynamik, 1857, p. 397.

be definitely stated. In 1744–5, Dr. Samuel Pye published a list of nearly three hundred persons to whom he had administered ipecacuanha, together with its dose, and the effects produced by it.[1] The average quantity which he gave was only *two* grains, yet it generally produced vomiting three or four times, and sometimes oftener. In about twenty of the cases it occasioned several stools besides. On the other hand, as will be shown under the head of *Dysentery*, sixty grains of the medicine have been given without any evacuation whatever following.

Cullen[2] taught that the powder "to the quantity of a grain, or perhaps less, in many persons can hardly be given without exciting nausea and perhaps vomiting. Yet in nine persons out of ten we need hardly depend upon any dose under five grains." "In small doses," he adds, "that do not excite vomiting, it pretty certainly acts upon the intestines." The ordinary practice of directing twenty grains as the emetic dose of ipecacuanha sufficiently shows either that the experience of physicians generally has proved the inertness of such quantities as were used by Cullen and Pye, or else that the powers of the drug have been greatly underrated. Some writers of the Italian school advocate the use of this substance as a counter-poison, looking upon it solely as a stimulant, and they cite cases in which, without producing any evacuation, it dissipated the phenomena of narcotism. If the facts are authentic, the explanation is unsatisfactory. The laxative action of ipecacuanha, when given in small and repeated doses, cannot well be questioned. If mixed with purgative medicines, it increases their power. This was long ago observed by Lewis,[3] who says that fifteen grains of jalap, with two or three of ipecacuanha, will purge more than twice the quantity of jalap by itself. From its milder operation as an emetic, it is preferable to antimonials for females, young children, and feeble persons generally, unless the nature of the disease call for a more powerful agent. It is unsuitable when a strong perturbative and sedative action is intended.

The action of *emetia* is identical in its nature with that of ipecacuanha.[4] A quarter of a grain of *impure* emetia, given to a man, caused nausea and vomiting, and a dose of from one and a half to two grains, taken fasting, caused protracted vomiting, and drowsiness. Lerminier estimated the power of impure emetia at about ten times that of ipecacuanha. But Domier, on the contrary, found from one to two grains of this substance necessary to excite vomiting with any certainty. *Pure* emetia is said to be three times as strong as the impure, and one-quarter of a grain of it to have the emetic power of twenty or thirty grains of ipecacuanha. One-tenth of a grain, given to a man fifty-eight years old, excited vomiting. But, like ipecacuanha, its action is not always in direct proportion to its dose, for Chomel gave it in doses of a quarter of a grain,

[1] Med. Obs. and Inq. (4th ed.), i. 240.
[2] Materia Med., ii. 475.
[3] Ibid., ii. 11.
[4] Reil, Mat. Méd., d. rein. chem. Pflanzenstoffe, p. 163.

gradually increasing to four grains, and it was only at the dose of one grain and a half that vomiting took place. On the following day a similar dose did not occasion vomiting. Another patient took twelve grains of emetia within twenty-four hours, without either vomiting or diarrhœa resulting. If these results represent the ordinary action of the drug, we may conclude that, like tartar emetic, it tends to establish tolerance when given in large doses.

Uses. *Diseases of the Lungs.*—Ipecacuanha is a valuable remedy in *acute bronchitis.* The symptoms which seem to indicate its use are a short, tickling, paroxysmal, and spasmodic cough, to relieve which small and repeated doses (half a grain every hour) are the most effectual. If nausea or vomiting is excited, the effect is all the more certain, for either operation promotes in a remarkable degree the bronchial secretion. In the cases alluded to, it may be usefully associated with acetate of ammonia, or some other saline or alkaline draught. This medicine is one of the safest and most efficient in *suffocative catarrh*, and it can be used with confidence either in old age or infancy. A case is mentioned by Higginbottom of its complete success in removing the accumulated fluids from the lungs in a patient seventy-eight years of age. Akenside states that he prevented suffocation from mucus in the air-passages in variola by its use.[1] Cruveilhier used the decoction or infusion (gr. cxx in Oiss of water) for the same purpose, or, as he more distinctly says, in capillary bronchitis. Of the quantity indicated, a glass was to be taken every half hour. This method, he remarks, excites nausea and a flow of saliva rather than vomiting, and produces easy discharges from the bowels. Under its influence the cough subsides, expectoration becomes freer, and the patients feel relieved.[2] In the suffocative catarrh of young children, and indeed in all the pulmonary affections of young patients which call for the use of emetics, ipecacuanha is the most efficient and safe. Very seldom, indeed, is the more powerful and perturbative action of tartar emetic requisite, and in general the milder agent should first be tried. In simple catarrhal laryngitis of the spasmodic form (*spasmodic laryngitis*) it will usually render unnecessary a recourse to the stronger medicine. In *chronic bronchitis* complicated with pulmonary emphysema it is very serviceable, both as an expectorant, and, during paroxysms of the disease, as an emetic. The accounts which have come down to us of its having cured consumption are doubtless to be understood as referring to chronic bronchitis with purulent expectoration. According to Delioux,[3] it is but little inferior to tartar emetic in the treatment of *pneumonia.* He used it according to the Brazilian method, described below, and found that it not only did not occasion diarrhœa, but rather confined the bowels. It subdued the pulse, excited perspiration, deprived the sputa of their bloody hue, and hastened the resolution of the disease. It was prescribed conjointly with depletion and vesication. Pécholier, Cade, and

[1] Trans. Lond. Coll. Phys., i. 102.
[2] Annales de Thérap., v. 340.
[3] Bull. de Thérap., xli. 152.

Broussonnet have furnished analogous reports.[1] The paroxysms of *whooping-cough* are sometimes rendered much milder by an occasional emetic of this substance. It was said by Akenside to be singularly efficacious in that form of *spasmodic asthma* to which hypochondriacal and hysterical subjects are liable, as well as females at their menstrual periods and at the menopause.[2] This author expressly refers to its operation in relaxing the "contraction which has seized upon the bronchia, and the membranous cellulæ of the lungs, so as to hinder the ingress of air." A scruple may be given at once when the paroxysm is violent, or when the disease is habitual. From three to five grains may be taken every morning, or every other morning. Murray mentions several cases in which the medicine produced complete relief in this distressing affection. If the results of Pécholier's experiments upon rabbits might be invoked, they would tend to explain the efficacy of ipecacuanha in bronchial affections by its general sedative operation upon the circulation, and its specific power of reducing the quantity of blood in the lungs. Undoubtedly, however, it is most useful when it acts as an emetic.

Diseases of the Stomach and Bowels.—Daubenton recommended minute doses of ipecacuanha to be taken in the morning fasting, for the relief of gastric debility, and constipation depending upon want of energy in the intestines.[3] The cases of *dyspepsia* which he describes are those in which the food lies heavy upon the stomach after meals, producing torpor of the body and mind, flatulent distension of the abdomen, cold extremities, general nervousness, uneasy and dreamy sleep, constipation, etc. He recommended the medicine to be taken in the dose of about one grain every morning fasting, and asserted that it so invigorates the stomach as to prevent the annoying train of symptoms which has been mentioned, and cause the bowels to be regularly moved. The efficacy of this method has been confirmed by Hufeland, Richter, James,[4] and more recently by Dr. Budd.[5] Ipecacuanha is much more efficient in all such cases when it is associated with the compound rhubarb pill. In the *vomiting of pregnancy* wine of ipecacuanha, in hourly doses of one drop, has in several cases arrested this distressing symptom which other remedies had failed to mitigate.[6]

Ipecacuanha was recommended by Fothergill[7] in an affection which he describes as "an habitual *diarrhœa*, depending on some irritating acrimony of the juices, accompanied with great weakness, and irritability of the bowels." This condition is described as being independent of structural alterations. A grain or two of ipecacuanha taken every morning before rising, with an opiate at

[1] Bull. de Thérap., l. 246; Br. and For. Med.-Chir. Rev., lxiv. 436; Bull. de l'Acad. de Méd., xxix. 549.
[2] Loc. sup. cit.; and Com. on Dysentery, p. 96.
[3] New England Journ. of Med. and Surg., v. 205.
[4] RICHTER, Ausfürlich. Arzneim., ii. 478.
[5] Diseases of the Stomach (Am. ed.), p. 260.
[6] Practitioner, iv. 61; Lancet, Dec. 1869, p. 768.
[7] Works, iii. 246.

bedtime, and a strictly regulated diet, is said to be very effectual in curing it. A very similar condition is that in which Richter and Vogt found the medicine so useful during the European wars of 1813, and which the latter describes,[1] in its acute form, as an asthenic flux, without irritating ingesta in the bowels, or high fever, but with tormina and tenesmus. In the chronic form of the same affection (*diarrhœa chronica a laxitate*) the stools are more feculent or mucous, but still passed with tenesmus and spasmodic pains in the abdomen, and the general health is much impaired by the interruption of the sources of nutrition. The dose employed was a quarter of a grain every half hour or hour, in connection with bitters, astringents, and tonics, particularly those of the aromatic class. It may be mentioned that *enemata* of ipecacuanha have been administered with alleged success in various bowel complaints by East Indian practitioners,[2] and very recently by Dr. Chouppe, of Paris.[3]

The esteem in which ipecacuanha was held as a remedy for *dysentery* may be inferred from the fact that it was first brought into notice as a specific for this disease, that it was commonly entitled "radix anti-dysenterica," and that Piso, its earliest historian, styled it the "sacred anchor" in bowel complaints. Murray's estimate of it was scarcely less exalted; but, as a capital point in its use, he enjoins that it be given while yet the inflammation of the bowel is superficial, and, so to speak, movable, and has not altered the structure of the intestine. Upon this point Richter also strongly insists. When thus employed, it mitigates the pain, renders the dejections less frequent, and removes their bloody character. A repetition of the dose is advised two or even three times in the first twenty-four hours. But the method of Piso was not closely followed by his successors, and the virtues of the remedy were less conspicuously displayed. Pringle, however,[4] thought that it succeeded best when it operated by stool as well as vomited. He, indeed, laid it aside on account of the distress produced by its action; yet he adds, "Upon the whole, I am not clear whether it is not the surest method of cure." Cleghorn used the medicine after the same plan.[5] Freind speaks of "that remarkable efficacy in dysenteric disorders which ipecacuanha challenges to itself."[6] Among recent writers, Cambay[7] insists upon its value after depletion. The number of citations might be multiplied; but, if narrowly examined, they make it evident[8] that not every form of the disease can be cured by this medicine, nor by every mode of exhibiting it. When the attack is brought on by cold, it is inferior to laxatives followed by simple opiates even at the onset; when by irritating ingesta, it has comparatively little advantage over other vegetable emetics or mild cathartics; but when the disease is epidemic, and

[1] Pharmakodynamik (3tte Aufl.), i. 309.
[2] Am. Journ. of Med. Sci., Jan. 1872, p. 254.
[3] Bull. de Thérap., Juin, 1874, p. 481.
[4] Diseases of the Army, p. 231.
[5] Diseases of Minorca (Am. ed.), p. 146.
[6] On Fevers, p. 39.
[7] De la Dysentérie, p. 563.
[8] ZIMMERMANN, De la Dysentérie.

assumes bilious characters, with bitterness of the mouth and a foul tongue, no remedy of the same class can be compared with ipecacuanha.

As was remarked above, when the treatment of dysentery by ipecacuanha was first introduced, large doses of it were given. In 1795, this practice was revived. Balmain,[1] who had been in the habit of giving the medicine in small quantities, found that a nostrum monger in his neighborhood had been extremely successful in treating dysentery by doses of a drachm and a half to two drachms. He imitated this practice with great advantage, administering the medicine in the form of a bolus, along with forty drops of laudanum, and, provided the patient kept quiet, and lay with his head and chest tolerably elevated, nausea seldom followed, and very often no stool occurred upon the following day. A few years afterwards (1803–4), Mr. Playfair employed the same method in Calcutta.[2] After trying small doses of ipecacuanha without effect, he prescribed from thirty to sixty grains with as many drops of laudanum. The first dose was sometimes vomited, but the second was always retained. Usually, for many hours after the medicine was taken, no inclination to stool was felt, and there was freedom from griping pain. When evacuations did at last occur, they were free, without pain, and unmixed with blood. Much more recently Delioux, who prescribed the medicine in large doses, but in decoction or infusion, and frequently repeated, found that after the vomiting and nausea occasioned by the first doses had subsided, tolerance was established; the abdominal pains were mitigated, the stools, though often more numerous the first day, were less so afterwards, and their characters were speedily modified, for they grew more bilious and consistent, and were even sometimes moulded; the pulse and heat of the skin subsided, and diaphoresis was established.[3]

This method, which is stated by M. Delioux to have been successfully employed in the French colonies in America, did not attract the attention it deserved until the reports of its successful employment by British physicians in India were published in 1858, and subsequently. In Peru and Brazil, whence was derived the first knowledge of the anti-dysenteric virtues of ipecacuanha, it still continues to be employed according to the original method,[4] or in the form of a decoction of the bruised root. Mr. Docker who led the way in reviving the original and systematic use of the medicine,[5] was followed by Cornish,[6] Donaldson,[7] Ewart,[8] Cunningham,[9] and others, whose testimony was unequivocal and sustained by ample experience. Instead, however, of employing a liquid preparation

[1] Mem. Med. Soc. Lond., v. 210.
[2] Edinb. Med. and Surg. Journ., ix. 18. [3] Bull. de Thérap., xli. 104 (1851).
[4] Whittingham, Amer. Journ. of Med. Sci., Oct. 1860, p. 381.
[5] Lancet, July, 1858, pp. 113 and 169.
[6] Ranking's Abstract, xxxiii. 91. [7] Edinb. Journ., v. 583.
[8] Brit. and For. Med.-Chir. Rev., xxxii. 58.
[9] Edinb. Journ., vii. 25.

of ipecacuanha, they administered it in substance and in doses averaging twenty grains each. The tendency to reject it by vomiting was controlled by administering, half an hour in advance, a full dose of laudanum and applying a sinapism to the epigastrium. The medicine itself was generally exhibited in the form of a bolus. Even when rejected after the lapse of half an hour or an hour, it was not repeated for twelve or from that to twenty-four hours. The value of the method is strikingly illustrated by its success in the hands of Mr. Cornish, who lost only four out of two hundred and ninety-seven cases, "giving a death rate of only 1.3 per cent. instead of 7.1 per cent., the average for a period of seventeen years." Dr. Ewart, remarking on the advantages of ipecacuanha treatment in congestive, exudative, and ulcerative stages of almost every form and type of acute dysentery, as well as in the acute attacks supervening upon chronic dysentery, describes them as consisting of: 1. Its simplicity. 2. Its safety. 3. Its certainty compared with any other method. 4. The promptitude with which the inflammation is stopped. 5. The rapidity with which recovery takes place. 6. Conservation of the constitutional powers. 7. Abbreviation of the period required for convalescence. 8. Decrease in the frequency of chronic dysentery. 9. Decrease in the frequency of abscess of the liver. 10. Diminution of mortality. 11. And all of this accomplished without bloodletting, salivation, calomel, or irritating purgatives."

Even in *chronic dysentery* the remedy has proved to be very efficacious, and more rapidly so than any other in the reported cases. It has been highly successful in the hands of Dr. Bulkley, of New York,[1] Dr. Willshire, of London,[2] and others. Administered according to the rules just indicated, it effected cures of cases which, from their long duration and the evidences they presented of cachexia and debility, would have seemed more likely to be disadvantageously affected by so perturbative a method of treatment.

Hemorrhages.—Numerous writers of high credit ascribe distinguished hæmostatic virtues to this medicine. One of the earliest of these is Mangetus,[3] who imputes to a dose of one drachm of the medicine the subsidence of an alarming hemorrhage from the *womb*, which preceded the expulsion of the ovum in a case of abortion. Dr. Osborne, of Dublin,[4] says that the treatment of simple *menorrhagia* by ipecacuanha has never yet failed in his hands, and that he has also found it successful in *epistaxis*. Cases of its success in *hæmoptysis* and menorrhagia are given by Frank.[5] Dr. Duckworth reports several cases of hæmoptysis, one of which was due to aortic aneurism, in which the discharge of blood was promptly arrested even by small doses of wine of ipecac.[6] Vogt says that it is only in habitual and chronic losses of blood that the medicine is useful: but the cases already referred to disprove this assertion. Trousseau

[1] Am. Med. Times, Feb. 1862, p. 64. [2] Lancet, July, 1862, p. 62.
[3] Biblioth. Phar. Med., iv. 1143. [4] Amer. Journ. of Med. Sci., xxvi. 453.
[5] Magazin für Arzneim., i. 548, and ii. 768.
[6] Loc. cit.

has several times used it with success in uterine hemorrhage, particularly after childbirth. He also found it to arrest an obstinate hæmoptysis in a female. The discharge of blood had continued, in spite of a variety of measures, for eighteen months, when ipecacuanha was administered, and the hemorrhage was suspended for three months. Mr. Higginbottom employed it with striking advantage in several cases of *flooding after delivery*, and when the exhaustion of the patient was such as to threaten speedy dissolution.[1] Dr. W. Martin reports a case of alarming hemorrhage from a lacerated wound of the tonsil, in which the flow of blood was promptly arrested by two grain doses of ipecacuanha every hour. The third dose occasioned slight vomiting, upon which the bleeding ceased.[2]

Trousseau insists upon the great advantages to be derived from emetics of ipecacuanha in the various affections which are apt to occur *after parturition*, and all of which, according to him, have a peculiar character impressed upon them by the recent delivery. He particularly refers to *acute dyspepsia*, *suppression of the lochia*, *subacute metritis*, *inflammation in the iliac fossæ*, *pulmonary catarrh*, and *subacute pneumonia*. It is very unusual, he asserts, for such disorders not to be removed, or at least greatly simplified, by the use of twenty or thirty grains of ipecacuanha in divided doses. Even when the disorders mentioned rise to the magnitude of serious inflammations, the symptoms are nearly always moderated by an emetic of this substance. An emetic dose of ipecacuanha is one of the best remedies for *urticaria* occasioned by special articles of food, or even by indigestion caused by suppressed perspiration.

In *intermittent fevers* of a bilious type, and still more in the *bilious* and *remittent* fevers which prevail in the autumn, and sometimes in the spring, diseases in which there is generally a dusky hue of the complexion, some yellowness of the conjunctivæ, a loaded tongue, sick stomach, and fulness of the hypochondria, the administration of a full emetic dose of ipecacuanha at the onset of the disease, and even for two or more successive days, forms, perhaps, the surest method of moderating the violence and shortening the duration of the attack. It also prepares the way for a successful administration of the preparations of cinchona.

Administration.—As an *emetic*, the usual dose of ipecacuanha is twenty grains in *powder*. It is most efficient when given in divided doses of five or ten grains repeated every ten or fifteen minutes until vomiting takes place freely. As remarked above, however, much smaller doses than these produce emesis in many cases, and much larger may be given without danger. For infants the proper dose is one grain of the powdered root or one fluidrachm of the syrup. It is usual to administer tartar emetic and ipecacuanha in conjunction in the proportion of one grain of the former to ten or fifteen of the latter. As in the case of other emetics, warm chamomile tea, or warm water simply, should be given to

[1] Lancet, June, 1845, p. 732. [2] New York Med. Journ., xiv. 177.

promote the operation of the medicine. The *infusion*, which may also be used as an emetic, is made by adding 120 grains of the powder to six fluidounces of boiling water; it may be given in the dose of a fluidounce, and repeated at short intervals. The infusion employed by the natives of Brazil, and recommended by Piso and Helvetius, is made with the bruised root in the proportions just indicated, and allowed to stand for twelve hours before being used. The liquid is then carefully decanted and fresh water supplied, and this is done for two successive days. Of the three doses, the first only produces much vomiting. Each is divided into two or more parts, which are given at intervals of two or three hours if the attack is mild, but if severe the whole dose is taken at once. The *wine* is a mild and convenient preparation, more suitable for feeble persons than antimonial wine. As an emetic it may be administered to an adult in the dose of one fluidounce; and in the dose of a fluidrachm, properly diluted, to a child a year old. As an expectorant or diaphoretic its dose is from ten to twenty minims.

As a *nauseant*, from one to two grains of ipecacuanha may be repeated at short intervals. As an *expectorant* and *diaphoretic*, the same dose may be given at longer intervals. For infants, the syrup may be used in doses of from five to twenty minims.

SANGUINARIA.—Bloodroot.

Description.—Bloodroot is the rhizome of *Sanguinaria Canadensis*, a native of nearly all parts of the United States. It is a small and delicate plant bearing a lobed leaf of very irregular outline and strongly reticulated with orange-colored veins on its under surface. The flower is white, and composed of eight or more spreading, oblong, obtuse petals. The leaf and flower appear together early in the spring. The rhizome is perennial, horizontal, fleshy, tuberous, and terminating abruptly (premorse). Externally it is of a reddish-brown color, but internally it is paler, and when wounded yields a bright orange-red juice of an acrid and bitter taste. After being dried it is very wrinkled and twisted, and by age loses much of its color, as well as of its acrid taste. The active properties of the root are presumed to depend upon the alkaloid *sanguinarina*, which is a white pearly substance of an acrid taste; it is soluble in alcohol, ether, and oils. Its salts, when dissolved in water, have an orange-red color.

History.—Sanguinaria began to be used by physicians in New England towards the close of the last century as an emetic in croup, in chronic coughs, and in jaundice. In 1803 it was made the subject of an inaugural essay by Dr. Downey, of Maryland, and between 1820 and 1830 notices of its virtues were published by Francis, Ives, Bigelow, and Tully. The last-named physician furnished the fullest account of the subject we possess.[1] The uncer-

[1] Am. Med. Recorder, xiii. 1.

tain strength of the preparations of sanguinaria, which rapidly deteriorates by keeping, has caused it to be supplanted by other medicines.

Action.—The description originally given by Dr. Tully of the operation of this medicine has not been materially modified by more recent observers, although it may be suspected that his account is overcharged. According to him in non-emetic doses repeated at short intervals, it augments the secretions of the liver and of the digestive organs generally, and as a consequence, where these are deficient, increases the appetite and promotes digestion. It also acts upon the mucous membrane of the air-passages, increasing or restraining its secretion according to its existing condition. It has also been known to excite the catamenial flow. In larger doses it strongly nauseates, lowers the pulse, and usually occasions "a quickly diffused and transient, and very peculiar nervous thrill, which pervades the whole system." In excessive quantities it sometimes excites vomiting, but more especially burning in the stomach, faintness, vertigo, diminished vision, and general insensibility, coldness, extreme reduction of the force and frequency of the pulse, together with great irregularity of action and often palpitation of the heart, great prostration of muscular strength, and sometimes, though rarely, a convulsive rigidity of the limbs. Cases are recorded of fatal results, from taking an overdose of the tincture, in which these symptoms were exhibited. These effects induced Dr. Tully to include sanguinaria, colchicum, and veratrum viride in the same group of medicines. The powdered root acts as an irritant upon the Schneiderian membrane, upon ulcers and certain cutaneous eruptions, etc. The late Dr. Thomas, of Philadelphia, found that *sanguinarina*, in the dose of one-sixth or one-fourth of a grain, given every two or three hours, produced nausea and sometimes vomiting, and the smaller dose, continued for several days at intervals of three hours, occasioned a manifest reduction of the pulse-rate. One grain, in solution, given every ten minutes excited vomiting after two or three doses had been taken.

Uses.—The chief uses of sanguinaria cannot be better indicated than in the words of Dr. Tully defining deobstruent medicines. "By deobstruents," he remarks, "I intend such articles as produce a general change of condition or action in the whole secernent and absorbent systems, and more especially remove torpor, and occasion improved and increased secretions from the liver and other digestive organs, and also from all the glandular viscera; and in all probability, by virtue of this operation, relieve certain dysthetic or cachectic diseases, and certain affections of the skin, and often likewise produce a direct resolution of many atonic, acute, subacute, and chronic inflammations . . . the whole independent of any direct change in the degree of the vital energies of the arterial system, or any material evacuation of any sort, as necessary accompaniments." These are terms such as are used to describe alterative medicines, and, indeed, the slow and gradual operation of bloodroot is of much more value than its emetic action, which is less certain

and much more distressing than that of ipecacuanha and other medicines of the same class.

The particular diseases in which sanguinaria has been used are too numerous to mention. Among them the following appear to have been most benefited. *Chronic dyspepsia* with diminished secretion of bile, sometimes jaundice, and accumulations of viscid mucus in the stomach and colon; but it is inferior as a remedy for this affection to mercurials in conjunction with saline cathartics and bitter tonics. It has been highly recommended in all forms of *bronchitis*, of a subacute or chronic type, accompanied or not with *spasmodic cough*, and particularly where the spasmodic element was highly developed, as in nervous asthma; but the association with it of opium or lobelia, recommended at the same time, destroys all confidence in the independent virtues of the first-named medicine. A similar remark is applicable to its use in *membranous croup;* in this affection it possesses, perhaps, a value equal to that of ipecacuanha and seneka, and should be regarded as a mere adjuvant to more energetic remedies. In the earlier histories of this medicine it was especially lauded as a remedy for various forms of *pneumonitis.* But this term is not a synonyme of pneumonia (for which Dr. Tully declares the medicine to be wholly unsuited); it was applied strictly to the inflammatory forms of *bronchitis.* Among these, suffocative catarrh was treated by its means; but with less success than when mechanical emetics were used. Nor does any evidence exist to demonstrate its superiority in any respect to the treatment of similar diseases by less depressing emetics, followed by diffusible stimulants and balsamic medicines.

Sanguinaria has been used with advantage in the treatment of *subacute rheumatism*, both muscular and articular, but it has no advantage over saline laxatives and diuretics associated with opiate diaphoretics. On the contrary, its operation is both more uncertain and more unpleasant; it may, however, be usefully added to the ordinary means employed.

The dry powder of bloodroot may be used as a sternutatory or errhine. It has sometimes occasioned the sloughing of *nasal polypi*, and been used to stimulate *indolent ulcers;* the fresh juice is said to cure *warts;* and an infusion or decoction has been applied with benefit to *chronic impetigo*,[1] and *eczema* of the skin.

Some years ago an American quack in England professed to cure *cancer* by means of a powder into which sanguinaria entered. A more efficient part of his method consisted in the application of chloride of zinc. The use of bloodroot in the treatment of cancer is, however, not novel. In 1811 Dr. Weatherby, of Philadelphia, described it as "a sure and long experienced antidote to expel all sorts of cancers."[2]

Administration.—As an emetic, the powder of sanguinaria may be administered in doses of from ten to sixty grains; or an infusion made by macerating an ounce of the bruised root in half a pint of boiling water for four hours, may be given in tablespoonful

[1] Philada. Journ., viii. 400. [2] Boston Med. and Surg. Journ., Aug. 1858.

doses at short intervals. One or two fluidrachms of the tincture will produce a similar effect. "As a deobstruent, expectorant emmenagogue and cholagogue, and as an acrid-narcotic, sanguinaria may be given in powder or pill, in uniform doses, at regular and short intervals, in the quantity of about five grains at once." (*Tully.*) The *tincture* (TINCTURA SANGUINARIÆ) is made by percolation from four troyounces of the root so as to obtain two pints of liquid. Its dose may be stated at from half a fluidrachm to one fluidrachm, as an expectorant or alterative, and at half a fluidounce as an emetic. A *fluid extract* is prepared of which each fluidrachm represents thirty grains of the root.

ALUMEN.	Vid. *Astringents.*
CUPRI SULPHAS.	" *Irritants.*
SINAPIS.	" *do.*
SCILLA.	" *Expectorants.*
TABACUM.	" *Nervous Sedatives.*
LOBELIA.	" *do.*
HYDRARGYRI SULPHAS FLAVUS.	" *Alteratives.*

CATHARTICS.

THE terms *cathartic* and *purgative* are derived, the one from the Greek καθαιρω, and the other from the Latin *purgo*. Etymologically, they signify *cleansing*, and were, therefore, applied to medicines which were supposed to purify the system of its morbid humors, whether they produced a discharge from the bowels, the kidneys, the lungs, or any other part. By modern usage their application is restricted to medicines which are employed to evacuate the bowels.

Hippocrates appears to have considered purgatives, and, indeed, emetics also, chiefly as evacuants, and to have subordinated their use to his views of the indications for expelling morbid humors from the system; hence he enjoins that in acute diseases they should not be employed until the signs of coction manifest themselves, and then that they should not be used too vigorously.[1] In another place he refers to the case of a man who died from the effects of a purge of elaterium, and while approving of the judicious use of cathartics under appropriate conditions, he points out the dangers incurred by those who use them without sufficient reason. Galen calls attention to the error of persons who congratulate themselves upon the copious operation of purges, forgetting or not knowing that it is usually followed by a confined state of the bowels. It is true that these precepts of the ancient physicians, which are reiterated by nearly all medical writers until within the last three or four centuries, had reference to drastic purgatives, which

[1] Edit. Fœsii, i. 46, 406.

were then the only ones in use. The introduction of saline cathartics, and generally of laxatives, belongs to a comparatively later date, and is to be ascribed chiefly to the Arabian physicians. So much mischief appeared to have been done by drastic medicines, in the hands of the vulgar and of ignorant or pretended physicians, that Hoffmann wrote an essay on the propriety of rejecting them entirely from the materia medica.[1] It is well known that the popular use of these remedies is quite as prevalent now as in the time of Hoffmann, and that, in spite of the fatal results of their injudicious use, and the trial and conviction of some of the more notorious quacksalvers for manslaughter by means of them, they continue to be regarded by the vulgar as the most efficient of all remedies. This partiality arises, in some degree, from the prejudice which the coarse and ignorant have in favor of whatever is vigorous or even rude in its action, but also, it must be confessed, from the unquestionable relief which cathartic medicines afford in many of the ailments of this class of persons, whom the habitual use of gross food, as well as the neglect of personal cleanliness and of the calls of nature, render peculiarly apt to be benefited by purgatives and depurative agents. The evacuant method, says Hufeland, has outlived all medical fashions and hypotheses, and we may with truth declare that, in a great number of cases, the intestinal canal is the field of battle upon which the issue of the most important diseases is determined.

Purgation is the exaggeration of a normal function, defecation. Nature has provided for a regular discharge of the innutritious portions of the food, and of the products of the decomposition of the body, chiefly through the intestinal canal. The frequency of this discharge is not the same at all ages, nor for all persons. In infancy it is very great, in old age, on the contrary, very slight. Ordinarily, indeed, during adolescence and adult life the greater number of persons have a single evacuation every day, but the exceptions to this rule are so numerous that almost any departure from it, unless attended with decided inconvenience, should not be considered as necessarily morbid. Many persons are uncomfortable unless they have several stools in every twenty-four hours, while many others evacuate the bowels but once in several days, and a few are relieved only at much longer intervals than this.

The causes of sluggishness of the bowels are various, but some of them may be mentioned here. One of the most common, at least among females who, from indolence or from necessity, lead a sedentary life, appears to be debility of the muscles of the intestines, which, it must be presumed, arises from the same enervating causes which waste and weaken the muscles of animal life. Of the direct influence of these causes upon weakness of the intestinal muscles there appears to be some doubt, or rather of the degree to which they contribute to torpor of the intestines, for it must not be overlooked that in the cases referred to there is a deficiency of the

[1] Opera Omn., iv. 284.

biliary and other intestinal secretions, which, in the normal state of the parts, serve to stimulate the peristaltic movements, and, still more, to preserve the fæces in so soft a condition as to render their propulsion easy, and prevent their distending the bowel by accumulation. The peristaltic action, moreover, contributes but slightly to the direct expulsion of the fæces. It is incessant and continuous whether the bowels are open or not, and probably in the fœtus, which has no alvine evacuation, as well as in the adult who is subject to constipation. On the other hand, defecation is a voluntary act in part, and in part, also, excito-motory, and is performed by the action of muscles which are indeed excited into contraction by the presence of fæcal matter in the rectum, but whose degree of action the will can regulate.

Infrequent opening of the bowels may arise from a cause the opposite of this. In a state of vigorous health, supported by active exercise, especially in very cold climates, and generally during the winter season of temperate regions, the fæces are scanty and very solid, because a larger proportion than usual of the food is appropriated to the nutrition of the body, especially to the formation of fat, and also, perhaps, because a great deal of carbonaceous matter, which would, under other circumstances, be excreted by the liver, is exhaled with the expired air from the lungs.

In estimating the causes which produce constipation, and conversely and by implication those which promote evacuations from the bowels, the influence of mental states must not be overlooked. The most pressing desire to go to stool may be suspended by some sudden emotion; habitual and prolonged constipation may proceed from a dull and melancholy cast of thought, and, on the other hand, pain and fear may produce a sudden and profuse evacuation, owing to the rapid secretion of a large quantity of liquid into the intestines. The sudden application of cold to the abdomen, or even to the feet, will also produce an opening of the bowels, which, in this case, appears to be due rather to an impression upon the spinal cord and a reflex action upon the abdominal nerves, than to any action on the bowels themselves. That their distension may produce catharsis is evident from the effects of large draughts of pure water, especially if they are taken when the intestinal canal does not contain much fæces, and partly, also, from those of saline mineral waters, in which the proportion of the irritant ingredient is very small indeed.

The primary action of purgative medicines is to irritate the mucous membrane of the intestine. The natural condition of food, in that it contains a large proportion of unassimilable constituents, seems to indicate that the latter are expressly provided for the purpose of stimulating the intestine by their mechanical impression. Food prepared in such a manner as to contain little or no unassimilable matter, soon exhausts the digestive powers, and, besides other evil effects, produces obstinate constipation. On the other hand, that which is largely composed of indigestible substances tends to increase the peristaltic action of the intestine, and the

ease and frequency of the evacuations, and hence is often employed as a remedy for constipation in the shape of pulpy fruits, mush or bread made of Indian corn, wheat-bran, oatmeal, etc. Other varieties of food irritate the bowel and produce diarrhœa, not so much by a mechanical as a chemical irritation, for example, vegetable acids whether contained in the pulp of unripe fruits, or extracted from them artificially; crude vegetables imperfectly prepared for digestion by culinary processes; and saccharine substances which undergo partial fermentation, and become acid in the stomach. But even among the unassimilable principles of food, all are not equally mere irritants of the intestinal mucous membrane. Some are susceptible of absorption, and after having been taken into the blood, are eliminated, in a more or less altered condition, by the glandular structures, and chiefly by those of the kidneys and the bowel.

Cathartic medicines, like the unassimilable portions of the food, are partially retained in the intestine, where they exercise a stimulant or irritant local action, and are partially absorbed from the stomach and small intestines, and are excreted by the several organs, but particularly by the large intestine, where their stimulant action gives rise to an augmented secretion from its glandular structure in addition to that already provoked by the direct irritation of the medicine.[1] All purgative medicines are absorbable, and the extent to which they are actually absorbed, either without change, or after solution in the juices of the intestine, will depend in a great degree upon their dose. Administered in minute doses, they are wholly absorbed, and impregnate the blood and the secretions formed from it without producing any purgative effect. Thus, it is a familiar fact that if we desire to have mercury display its constitutional instead of its cathartic influence, it must be administered in minute doses, or be so guarded by opium as to prevent its irritating the bowels and passing off by them. Salines, even when they purge, augment the secretion of urine, and it even happens sometimes, that, in small doses, or in the form of natural mineral waters, they act upon certain persons as diuretics, in whatever dose they may be taken. Apart from these, and saccharine mucilaginous substances, all other purgatives act chiefly as local irritants, and contain an active principle with more or less acrid properties.

On the other hand, by whatever channel they may be introduced into the body, cathartics tend to pass off by the bowels, and in doing so to purge. This fact, although unexplained until a recent date, was not unfamiliar to the earlier physicians. Hoffmann speaks of the ancients having produced purging by means of pediluvia of

[1] This doctrine, for which a modern and indeed a quite recent origin is commonly assumed, is in reality the most ancient of any relating to this subject, for it dates back to the fourth century before the Christian era. Aristotle is thus quoted by Dr. Adams: "When purgatives are conveyed to the stomach, and are there dissolved, they are carried by the same passages as the food, and when they cannot be digested, but their prevailing power remains unsubdued, they return, and carry with them whatever opposes them, and this is called purging." (Problem. 43, in Comment. on Paul. Æginet., iii. 485.)

a decoction of hellebore; of purgative ointments being applied to the skin of the abdomen; of purgation having followed the application of an ointment of hellebore to an issue, and that of an ointment containing colocynth to the umbilicus.[1] Examples of a similar effect have been cited in the introduction to this work; and Dr. Salgues, of Lyons, has also reported a number of cases in which powdered colocynth or aloes applied to the denuded derm provoked a full cathartic operation.[2] Experiments were long ago performed with laxative substances injected into the veins by Fabricius, Haller, Hunter, Hale, Magendie, and others, demonstrating their specific action when thus introduced into the economy. It is not, however, to be inferred that the medicine, in whatever manner it may be introduced, is confined in its operation to the bowels. But here alone is its peculiar action manifested, and here, perhaps, it is principally eliminated, although, for a time, it probably impregnates all the secretions. When injected into the veins its taste has sometimes been perceived in the mouth, and its constituents are well ascertained to have been present in the urine, milk, etc. Pliny relates that the daughters of Prætus were cured of insanity by drinking the milk of goats fed with hellebore; and that when these animals browse on ground ivy their milk is curative of diseases of the spleen.[3] It was also long vulgarly known that the milk of mothers who use purgatives often relaxes the bowels of their infants.

The general operation of cathartic medicines depends partly upon their local and direct irritant action upon the surface of the bowels and partly on their local but indirect irritant action developed as they pass through the bloodvessels or the glands of the intestinal canal. By both operations the activity of the circulation in its mucous membrane, and consequently in its secreting glands, is increased; a discharge of fluids takes place into the cavity of the intestine, mingling with and diluting its previous contents, while it stimulates the muscular coat to more active contraction, both by its own presence and that of the blood in the vessels, and by the increased bulk of the contents of the bowel. These contents consist partly of the indigestible or the undigested remains of the food and partly of the effete products of nutrition; for it must not be forgotten that the colon is the great reservoir in which the waste materials of the economy are deposited before being finally cast forth from the body. Now, it is probable that purgative medicines which are absorbed, and particularly those of the saline and resinous groups, are excreted by the same channels through which the ordinary secretions into the colon take place, and, as was just remarked, they cannot during their passage fail to stimulate the intestinal glands, and consequently to hasten the elimination of effete matters from the blood, as well as whatever specific material causes of disease may there exist, and also to quicken those destructive changes

[1] Opera Omn., i. 214, 435; see also PAULUS ÆGINETA, ed. Syd. Soc., iii. 502.
[2] Abeille Méd., ii. 30.
[3] Hist. Nat., liv. xxv., ch. xxi. and xxxiii.

in the tissues which, within due limits, are absolutely essential to the preservation or the restoration of health.

The universality of the treatment by purgatives is explained by this view of their operation. There is hardly any disease, whether acute or chronic, in which the process of nutrition is not disordered, and in which the normal secretions, and therefore the due elimination of the products of the destructive processes of nutrition, are not interfered with. There are also some in which certain alvine evacuations proper to the disease suggest or represent the natural process of its cure, and which it is, on the one hand, hazardous to interfere with, but generally most salutary to promote, if care be taken to prevent their running into excess.

The evacuations produced by purgatives vary with the different agents employed, both in regard to their quantity, consistence, and composition. Their quantity depends, at least in the first instance, upon the amount of food and fæces which may happen to be present in the intestinal canal. The first discharges are usually fæcal, and the subsequent ones are less consistent and more or less mixed with partially digested food. These are followed by the mucous and biliary fluids in various proportions. The more or less prolonged sojourn of the fæces in the bowels, as well as the state of its glandular, and especially of its biliary, secretion, render their color various, from the paleness of clay to an almost inky blackness, with intermediate shades of yellow, brown, and green, the last almost exclusively in infants. But yellowish stools, which are sometimes supposed to be bilious, may derive their color from rhubarb or gamboge used as a purge. Among the laxatives, the salines, appropriately dissolved, produce copious and watery evacuations, with more or less borborygmi and griping, and sometimes a scalding sensation in the anus. Magnesia is very apt to be partially evacuated in substance, as shown by whitish streaks or nodules in the stools; and castor oil is usually found floating in a thin layer, or in globules upon the surface of the discharge. The operation of drastic purgatives is generally preceded by severe griping pains and heat in the abdomen. The stools at first contain fæces of a greater or less degree of consistence, cylindrical or homogeneous, or composed of a mass of small rounded portions more or less compressed together, and followed by serous, mucous, or bilious matters, still or frothy, and gelatinous, purulent, or membranous, according to the existing condition of the chylopoietic viscera.

Besides the spasmodic pain and more or less constant warmth in the abdomen, excited especially by drastic cathartics, the rectum and anus, which are endowed, the one with a powerful muscular apparatus, and the other with common sensibility, are apt to become irritated and thrown into violent spasmodic action, known as straining or tenesmus, during the throes of which mucus tinged with blood may be discharged, or the mucous coat of the rectum may protrude, while the hæmorrhoidal veins, turgid with blood, oppose the return of the tumor. Or the irritation of the rectum may be propagated to the adjacent organs, exciting in the female

uterine hemorrhage or vaginal leucorrhœa, and in the male tenesmus of the bladder or dysury. Of all purgatives, aloes is most prone to irritate these parts.

The *general* or *constitutional* effects of purgative medicines are various. Some, like gamboge, produce a sickening sensation of the stomach, which is followed by general debility, discomfort, and depression. Castor oil induces a disposition to repose, and even sleep; and saline cathartics occasion a marked chilliness and coolness of the extremities, and a general sensibility to cold. A similar effect is ascribed to calomel. When an excessive dose of a purgative medicine, and especially of the drastic class, is administered, there is experienced, in addition to severe abdominal pain, a marked tendency to collapse, the whole cutaneous surface may become shrunken and cold, the extremities be affected with cramps, the features pale and sunken, the pulse weak, rapid, and thready, and along with tenesmus, and profuse watery or scanty mucous and bloody stools, there may sometimes be associated violent vomiting or retching, and the patient may die from exhaustion. If recovery takes place, it is through a reaction which has all the characters of an inflammatory fever.

The *remote* effects of purgative medicines are implied in the preceding sketch of their operation. As local irritants they are revulsives, yet feebly so in comparison with cutaneous irritants, besides which, this property is masked, and infinitely exceeded in usefulness by their depletory effects. But it must not be overlooked, as a disadvantage attending their irritant action, that it is necessarily followed by torpor of the intestines and their associated viscera. It is difficult to adjust the administration of purgative medicines so that they shall not leave behind them this result. Castor oil is, indeed, said to occasion less confinement of the bowels with each successive dose, when it is used as an habitual laxative, so that it may be given in constantly diminishing quantities. But a single full dose of it is more prone than other medicines of the class to produce constipation.

The *evacuant* operation of purgative medicines, it will be remembered, is not confined to the removal of the contents of the bowels, but promotes the depuration of the blood besides; and thus, by a double action, tends to remove from the system the causes of disease, as well those which might enter from the intestinal canal as those which are generated by the decomposition of the tissues, or have been received from without, either through the lungs or the bowels. To these may be added another, and in some cases a very important, mode of action, that of promoting absorption from the intestines. Purgatives here act partly by removing the accumulated secretions which impede the absorption of the nutritive juices. These "sordes" of the ancients are not of questionable existence, as in the case of the stomach, for they have often been demonstrated by the inspection of dead bodies, especially of those which were also found to contain intestinal worms. Their action must necessarily be to interfere with the influence of the digestive juices upon

the food, and still more to obstruct its absorption by the lacteals. Now, purgatives remove this obstacle to nutrition, while they directly quicken the function by their stimulant impression.

The *depletory* action of purgatives is that which renders them applicable to the cure of so large a number of diseases; to nearly all, indeed, which involve an inflammatory or congestive element. In addition to the constitution of the blood, so far as it contains morbid elements, and which was noticed in the last paragraph, it must not be overlooked that the mere bulk of the circulating fluid is often a serious aggravation of disease, and that much suffering and much imperfect performance of function may be prevented by reducing the tension of the bloodvessels. A more direct manner of accomplishing the same object is venesection. This important agent, which a medical fashion has caused to be temporarily laid aside, is closely imitated in its operation by cathartics, and especially by those of the saline and the drastic groups. But while venesection removes all the elements of the blood alike, purgatives abstract only its watery portion, and hence the latter must be considered as only supplementary to the former, or as an appropriate substitute for it whenever the treatment is intended to be sedative rather than spoliative. The element withdrawn from the body by venesection is vital, and has required a long elaboration to perfect, and its loss is one which the system is slow to repair; but that which purgatives remove is little else than water, and it is replaced speedily and without difficulty. In some diseases, as in serous plethora and dropsy, direct depletion is inadmissible; but indirect depletion by purgatives which produce copious watery stools will carry off the excess of fluid, and allow an opportunity for a radical cure by other means. They accomplish this object indirectly, by depriving the blood of a portion of its watery constituent, and thus enabling the veins to take up the fluid which is effused in the cellular tissue or elsewhere.

Several *classifications* of purgative medicines have been employed. The most ancient was founded upon an observation of the quality of the discharge which they provoked. There were *eccoprotics*, or medicines which promote the expulsion of fæces without augmenting the intestinal secretions in a marked degree. Among these none can be included which are properly purgative. But many tonics, and particularly nux vomica, exert such a power, directly or indirectly. *Laxatives* are medicines which occasion soft, but not necessarily liquid, discharges, and of these castor oil, manna, and sulphur may be taken as examples. *Purgatives* proper are those which produce more liquid discharges, and irritate the intestine, but not to an excessive degree. Calomel, the salines, senna, and rhubarb may be classed under this title. Finally, *drastics* are purgatives which operate powerfully, and produce a lively, and, in excessive doses, a violent irritation of the intestinal mucous membrane. A more ancient and specific nomenclature was based upon the fact that different purgative medicines excite evacuations, each of some one secretion rather than another, and this arrangement,

founded upon accurate observation, lent no slight support to the humoral doctrines of disease which so long prevailed in medicine. The principal divisions according to this system were *cholagogues*, or cathartics which provoke a discharge of bile, *phlegmagogues*, or those which procure mucous stools, and *hydragogues*, which excite watery evacuations; and the daily experience of every physician in the use of purgatives confirms the appropriateness at least of the last two divisions of this classification.

The principal hydragogue cathartics are the salines, elaterium, jalap, black hellebore, gamboge, colocynth, senna, and croton oil. The following may be classed as phlegmagogue, viz., olive oil, castor oil, cassia, manna, sulphur, rhubarb, and aloes. The division of cholagogues is less strictly defined. The ancients (Mesue, Serapion, and others) included in it aloes, rhubarb, cassia, manna, hellebore, squill, scammony, colocynth, elaterium, and other less active cathartics besides; and Marggrave, in the seventeenth century, enumerated nine agents of this class, the three principal of which were scammony, rhubarb, and aloes.[1] Finally, Headland admits mercury alone to be a true cholagogue, and states that all cathartic medicines act as indirect cholagogues. But the claim of mercury to this distinction, on the ground of its *specific* action upon the liver, is not established.

Torpor of the liver—by which, it is presumed, a diminished secretion of bile from functional causes is intended—is probably owing either to some general condition of the system which lessens the amount of all the secretions, or to an impaired activity of the gastric digestive function. In all diseases except acute febrile affections, the latter appears to be the ordinary source of this derangement. We know that in a healthy state of the constitution every stimulus applied to the gastric mucous membrane solicits a flow of bile, and it is altogether probable that the freedom and copiousness of its discharge depend first upon the presence of food in the stomach, and then upon the proper changes in that food having been accomplished by means of the gastric juice. If the stomach fails to receive food, or to prepare it for the action of the alkaline liquids, the bile and pancreatic juice, which meet it upon its entrance into the duodenum, there is no proper demand for the secretion of the liver, and that organ ceases to eliminate bile. It seems probable that what is usually called torpor of the liver is oftener torpor of the stomach and duodenum, and hence that to attempt its cure by addressing remedies to the liver itself is to apply them to the wrong end of the chain of morbid causes.

The list given above of medicines which the ancients held to be cholagogue shows conclusively that they included in this division of purgatives all which, in appropriate doses, are capable of exerting a lively impression upon the intestinal canal, and particularly of exciting serous discharges, and thereby "unloading" the portal vessels, and indeed the circulation of all the chylopoietic viscera.

[1] ALSTON, Mat. Med., i. 45.

Such an operation must necessarily have for an effect the quickening of the intestinal and the pancreatic as well as the hepatic secretions, and more remotely the better performance of the digestive function. Among them there are two—aloes and rhubarb—which contain bitter principles, and which are probably in a peculiar sense cholagogue, because by virtue of this element they may possibly to some extent act as the bile itself acts, and consequently promote changes in the food adapted to solicit the secretion of the liver. At the same time it must be admitted that the yellow color of the dejections which they provoke lent some plausibility to, if it did not indeed suggest, the idea that they promote a discharge of bile.

It is certain that mercurial medicines are not cholagogue by virtue of their stimulant or irritant action upon the intestinal mucous membrane, since the very mildest and least irritating among them are those precisely which are especially regarded as stimulants of the liver; and consequently if they excite the biliary secretion, it is because they are absorbed, and either stimulate the liver in consequence of their specific direction to that organ, or by modifying the condition of the blood they promote its secretion in common with that of all the other glands. The latter is almost certainly their real mode of operation, and one that is often displayed by alkaline medicines, which have also been classed as cholagogues. The proofs of this mode of action, particularly in the case of mercury, will be found in another part of this work; but we think enough has here been said to render it highly probable that there are no such medicines as cholagogues in the sense of their having a specific power of stimulating the secretion of the liver alone.

An arrangement founded upon the mode of action of medicines belonging to the present class, and which is most in accordance with the existing state of knowledge, is that proposed by Mialhe,[1] who, if he does not always satisfy the judgment by demonstrating a coincidence of his conclusions with those of clinical observation, has, nevertheless, we are persuaded, adopted the only method of investigation which can lead to accurate results, either in theory or practice. All cathartics, which are not merely mechanical irritants, are either soluble or insoluble. The former either possess a coagulating influence, enabling them to combine with the tissues, irritating them and augmenting their secretion, as in the case of croton oil; or else are destitute of that coagulating power, but either by endosmosis, as in the case of the salines, or by a peculiar power of stimulating the mucous membranes, and which Mialhe terms *sapidity*, as in colocynth and aloes, provoke an increased discharge of fluids. The latter, which are partially or wholly insoluble, as gamboge, scammony, jalap, and castor oil, are rendered soluble by the alkaline liquids of the economy, magnesia by its acids, and calomel by its alkaline chlorides. The following remarks will aid in illustrating the propriety and utility of this classification.

[1] Chimie Appliquée à la Physiologie et à la Thérapeutique, Paris, 1856.

Croton oil, when taken in large doses, is probably absorbed, and, as elsewhere stated, appears to be capable of producing in this manner its specific eruption upon the skin. But it is equally true that its ordinary operation appears to be confined to the intestinal mucous membrane which it actively irritates. Saline purgatives, on the contrary, given in weak solution, become diuretic, and when in a concentrated form, they excite an endosmotic and exosmotic action, the result of which is a discharge of serum into the intestine, while a certain proportion of the same solution is absorbed into the blood, and tends to render the urine alkaline.[1] Mannite, the active principle of manna, has also been detected in this secretion. Aloes and the resins, it is affirmed, which are only partially soluble in water, become entirely so in the alkaline secretions which pervade the lower bowels; and it is given as a reason why they so seldom disorder the stomach, that the fluids of that organ are acid and not alkaline. Hence, it has been found advantageous to prescribe them in pilular form, and associated with soap, which hastens and facilitates their solution. Castor oil, probably, acts by virtue of the acrid principle which it contains, but in so far as it is absorbed, the conditions for its absorption are chiefly furnished by the alkaline secretions of the colon. According to Mialhe, calomel (protochloride of mercury), which, it is well known, is insoluble, is rendered soluble by the alkaline chlorides (chloride of sodium) which it meets with in the stomach, by undergoing conversion into a soluble bichloride. The poisonous effects of this compound are prevented, it is said, by the slow and gradual manner in which its conversion takes place, and by its immediate union "with the alkaline chlorides and the albuminous elements of the blood to form a double chloride, which is very different in its action from the uncombined bichloride."

Therapeutical Application of Cathartics.—The uses of these medicines depend upon their possessing evacuant, revulsive and depletory, and depurative virtues.

The *evacuant* operation of cathartics has reference chiefly to the existing contents of the intestinal canal, although it must be attended with more or less of the associated actions. Its object is to remove those substances, which, by their local irritant impression or by absorption into the system, interfere with the healthful performance of its functions. They may consist of ingesta which, in the actual state of the digestive organs, are unassimilable, or of excreta which are unduly retained. According to the condition of the

[1] It is asserted that when a saline solution, of sulphate of soda for example, is taken into the stomach or injected into the veins, its density will in either case determine whether it will act purgatively or not. A small dose taken into the alimentary canal will not purge but be absorbed forthwith into the blood, and be eliminated almost entirely by the kidneys; in proportion as the dose is increased more of the salt will be discharged from the bowels and less with the urine, provided that the proportion of water used to dissolve it be small. But when the watery solution is very abundant, a comparatively small proportion of the saline ingredient will be required to purge, a fact which is familiarly illustrated by the operation of natural mineral waters.

bowels, they may occasion diarrhœa or constipation. It is of the latter we shall in the first place treat.

Constipation.—When the action of the bowels is diminished in consequence of an immoderate quantity of food, especially of a rich and stimulating quality, there is usually more or less gastric derangement, nausea, and oppression, a bitter or pasty condition of the mouth, and loss of appetite; the abdomen is distended and hard, and is the seat of uneasy sensations, including fulness and more or less colic, a sense of pressure about the anus, often enlargement of the hæmorrhoidal veins, with general malaise, some headache, muddiness of the complexion, feverishness, and turbid urine. Under these circumstances, three or four grains of blue mass followed by a dose of the infusion of senna with Epsom salts; or else the compound extract of colocynth with a small proportion of calomel or blue mass, will cleanse the bowels effectually of their offending contents, and dissipate all the symptoms to which their presence gave rise. This form of indisposition is probably due either to the excitability of the bowels having been exhausted by the undue quantity or the quality of their contents, or by the accidental influence of mental causes of an exciting nature, and if not thus treated is apt to work its own cure by a spontaneous diarrhœa, provided that a proper abstinence from food is observed.

Habitual constipation may proceed from a variety of causes, some of which reside within the intestine itself, while others are external to it. It is probably in the colon, the organ of defecation, that the greater number of the former exert their influence. They may consist of a *deficiency of the natural secretions*, which, while they give the fæces a proper consistence, either stimulate the bowel to a due degree of persistaltic action, or mechanically promote the progress of its contents by lubricating the mucous membrane of the colon and rectum. The fæcal mass, if retarded in its passage, gradually loses its moisture by absorption, and enlarges by the accretions which it receives from above, until it finally distends the bowel, overstrains and paralyzes its muscular coat, and thus leaves no means of relief except from purgative medicines. For such a condition, those which correct its causes are the most appropriate; laxatives which soften the obstructing mass, and purgatives which promote its expulsion, such as salines with resinous cathartics, aloes and colocynth with Epsom salts, for example. The most ordinary causes of this form of constipation are want of muscular exercise, and with it an undue or a painful application of the mind, or any other cause which, while it tends to diminish the intestinal secretions, leads to a neglect of the calls of nature. The universal habit of taking the meals at regular hours involves the necessity of an equally regular and periodical evacuation of the bowels, for in all healthy persons very nearly the same number of hours must be required for the digestion of the food and the arrival of the fæcal mass in the rectum, where it excites a desire for and a tendency to its evacuation. If the call of nature, as it is most aptly termed, is not obeyed, the rectum gradually loses its sensibility to

the stimulus, and an accumulation takes places in it of fæcal matters which sometimes attain an enormous size, filling the entire cavity of the pelvis, and gradually becoming so dry and hard that no means except mechanical ones can any longer avail to dislodge the mass.

Closely allied to the form of constipation just noticed is one which is frequently associated with it, and which is generally ascribed to *muscular atony*. It is of very common occurrence as a part of general debility, whether this belong to the patient's original constitution or is the consequence of muscular inaction or of exhausting chronic diseases which impair the strength of all the functions. It would seem to be peculiarly an incident of diseases which impair the nutritive qualities of the blood, and of those in an especial manner which are characterized by a deficiency in the proportion of its red corpuscles, viz., anæmia and chlorosis. But in these affections a purgative treatment addressed to the removal of the constipation must be so managed as not to exhaust the system. Hence those medicines of the present class should be selected which do not provoke copious discharges, and so combined as to insure their moderate action on the whole of the intestinal canal. It is often of the highest importance that they should also be associated with tonics. Of this description are the pills and mixtures which long experience has proved to be the most efficient in chlorotic amenorrhœa.

Mechanical obstructions are frequently a cause of constipation. Such are contractions of the bowel by the deposit of cancerous or fibrous matter in its coats, and the accumulation of indigestible articles, such as fruit-seeds or stones, bran, magnesia, charcoal, etc. Others are external to the bowel, and compress it, as displacements of this organ (invagination, herniæ), retroversion of the uterus, and tumors of any of the organs or parts within the abdomen. Of the internal causes some are removable by purgatives, but of the external scarcely any are susceptible of removal by these means. A simple reference to those which have been mentioned is sufficient to show that many of them not only cannot be removed, but that their effects must be seriously aggravated by purgatives. If the cause of constipation is uncertain, the attempt to remove it should be made with great caution, the milder purgatives alone being used for the purpose; and, indeed, those of the drastic class should never be employed when there is any reasonable doubt of the freedom of the intestine from organic obstruction either within it or without.

Finally, constipation may depend upon affections of the *nervous system*. In various inflammatory, organic, and even functional diseases of the brain and the spinal marrow, this condition forms a prominent symptom, and one which can rarely be combated without a resort to active medicines of the cathartic class. But if the cause continues in operation the effect will continually be reproduced; and this is the case in most of those affections whose tendency is towards a fatal issue. But fortunately in those among

them susceptible of cure, or even of palliation, purgatives are beneficial by their revulsive as well as by their evacuant operation. In one group of them, nervous disorders produced by lead, these medicines are eliminants of the material cause of the disease, viz., the lead in the tissues, and, at the same time, are evacuants of the bowels and stimulants of the spinal nervous system.

It has already been noticed that purgatives have always been favorite remedies with the vulgar on account of their sensible effects, and of the immediate relief from suffering which they often afford. Too little regard is paid to their secondary effects; too much inclination is shown to depend upon them instead of adopting the slower but more certain method of cure by means of a regulated diet and exercise, and of tonic medicines adapted to restore the bowels to their normal strength. A mere purgative operation calls upon the intestinal muscles to make a powerful exertion; they become exhausted by this expenditure of strength, and speedily fall into a state of atony more complete than that from which they had been aroused. Hence the mischiefs of habitual purgation. Even if continued and increased torpor of the bowels were the only evil, it might be borne. But the constant use of purgatives irritates the stomach, impairs the appetite, occasions flatulence and dyspepsia, and may possibly become a cause of chronic thickening, hæmorrhoids, or abscess of the rectum, etc. Especially are they to be used moderately, or avoided, if possible, when the patient is of a nervous and susceptible temperament. In such cases comparatively small doses of these medicines will be found requisite, while in persons of a torpid nature, with thick skin, heavy features, and an impassible nervous system, the stronger and more depletory agents are to be preferred. But whenever the debility which may exist, with its accompanying symptoms, depends upon confinement of the bowels, they should be released by whatever degree of active treatment is necessary for the purpose, it being always borne in mind that in such cases clysters should precede purgatives, as being less exhausting, and more speedy in their action.

Biliary disorders, without so much derangement of the digestion as of discomfort in the right hypochondrium, enlargement of the liver, and jaundice, are most effectually relieved by purgatives, preceded, according to a custom which rests upon theoretical rather than practical grounds, by small doses of mercury, and especially of blue mass. Saline medicines are usually to be preferred, particularly if administered in a very diluted form. On this account natural saline mineral waters are peculiarly efficient.

Diarrhœa is a symptom of various pathological conditions from the slightest to the gravest, from the most transient irritation or congestion to a destructive ulceration of the mucous membrane of the intestines. It may be caused by all ingesta irritating by nature or rendered so by the existing morbid susceptibility of the bowel; by a profuse secretion of bile, such as is apt to occur during the hot season of the year, or from errors of diet, and particularly the ex-

clusive use of either vegetable or animal food; by secretions from the mucous glands containing some morbid element, such as that derived from the repercussion of certain cutaneous diseases and the effluvia of putrefying organic matter; or by the stimulus of over-distension when the body is weakened, as in cholera. It may also be caused by morbid conditions of the mucous membrane itself, including congestion or inflammation arising from the action of cold upon the surface of the body, ulceration of the glands from the deposit of typhoid or tuberculous matter in them, or by a debility generally attended with atrophy of the mucous membrane. Finally, diarrhœa may be excited by irritation in a remote part, as in the nerves of the teeth during dentition, or by mental emotion. It is true that during the pain of dentition the biliary secretion is diminished, and hence the food undergoing fermentation probably acts as a direct irritant; but after violent agitation of the mind there can be no doubt that the liver is excited to pour out its secretion profusely, which occasions diarrhœa by its irritating qualities, as well as by the bulk of the liquids secreted.

Such various conditions must necessarily require different agents for their cure, and for the relief of the diarrhœa which is common to them all. Yet it is evident that those which arise from the presence of irritating ingesta or secretions must be proper objects for the evacuant operation of purgatives; that all which involve a simple inflammatory element of moderate severity must be benefited by the depletory and substitutive action of the same medicines; and that those, even, in which the local lesion is the effect of an effort on the part of the system to rid itself of noxious matters may be palliated by their eliminative action. On the other hand, the diarrhœa produced by mere debility cannot but be aggravated by any of the modes of action of these medicines; and that which is the consequence of reflected irritation, whether physical or mental, is often a conservative act upon the part of the economy, which protects or relieves the vital organs, and should be treated by means addressed to the cause rather than to the effect.

Nearly all of the conditions specified in the preceding paragraph as being adapted to a treatment by purgatives are more favorably influenced by those of the saline class than by any others, when given either alone or in conjunction or alternation with mercurials, the latter being generally employed when gastro-hepatic symptoms are prominent, and the former when inflammatory action and fever prevail. Simple diarrhœa from cold, or from the presence of undigested food in the intestinal canal, yields more readily to castor oil, which has the advantage of leaving the bowels somewhat confined when it has been administered in a single full dose, especially with the addition of a few drops of laudanum. When the discharges are very acid, as often is the case in children, magnesia is the most appropriate remedy; and when the diarrhœa is dysenteric and of a typhoid type, it is very favorably modified by rhubarb, because the tonic and astringent virtues of this medicine co-operate

with its purgative action. In sthenic forms of dysentery, calomel and especially the salines are to be preferred.

Intestinal worms are among the abdominal disorders in which purgative medicines are most useful. They are generally prescribed to be taken after the administration of agents which are directly hostile to the life of these parasites, aud they should therefore be selected from among those which produce an abundant secretion of intestinal fluids, such as senna, jalap, gamboge, etc., and which thus tend not only to carry away the dead or weakened worms, but also to dislodge the mucus in which they are apt to be enveloped. Calomel, which is both vermicide and purgative, is one of the most efficient remedies of the present class when used alone.

The medical writers of the last century were in the habit of employing purgatives in the treatment of *continued fever*, but in general without distinguishing between typhus and typhoid fevers. Among those, however, who, like Huxham, did recognize the radical differences of these two affections, mild purgatives and laxatives were prescribed in the former, but condemned in the treatment of the latter. "I have known," says this writer, "a common purge injudiciously given at the beginning of this fever immediately followed by surprising languors, syncope, and a large train of other ill symptoms; however it may be necessary sometimes, even at the beginning, to cleanse the primæ viæ by a gentle puke, a little rhubarb, manna, etc., if you give anything drastic, be assured your patient will rue for it, and you will repent it."[1] More modern observations have shown that a systematic treatment of typhoid fever by laxatives is attended with a less mortality than when depletion, stimulants, or tonics are chiefly depended upon, and over these methods it has the advantage of shortening the disease, and preventing, in a great degree, such complications as bed sores, hemorrhage, and perforation of the bowel. Yet when compared with an expectant treatment, in which particular symptoms are combated as they arise, while the general management of the disease is committed to hygienic influences, there is nothing to manifest the superiority of evacuant measures. Indeed, typhoid fever would constitute an exception to all self-limited diseases if any treatment whatever were competent materially to shorten its duration or diminish the mortality which belongs to it under a mild expectant system. If, however, medicinal alvine evacuations are thought desirable in any case, they should be procured by means of castor oil or saline laxatives, which are usually recommended (apparently upon theoretical grounds, if not under the influence of a mere habit acquired during the sway of a medical hypothesis) to be prescribed in conjunction with small, or so-called alterative, doses of blue pill or calomel.

One of the most valuable applications of purgatives is to the treatment of *serous plethora*, a sort of dropsy of the bloodvessels,

[1] An Essay on Fevers, 7th ed., p. 81.

which is very common during pregnancy and in chlorosis. It is this condition which has led to the custom, at one time universal, and still common among the vulgar, of considering bleeding one of the necessary incidents of the pregnant state; but while depletion relieves the plethoric condition, it robs the blood of its most important element, the red corpuscles, and predisposes to a renewal of the symptoms in a more aggravated degree. An equal alleviation is procured by saline laxatives, particularly when they are associated with diuretics of the same class, without any loss of strength. Similar remarks are applicable to the serous plethora of chlorosis. Evacuant, tonic, and ferruginous medicines, in due proportion, are often essential to the successful management of this disease.

The evacuant operation of cathartics has always rendered them the principal agents used in the treatment of *dropsy* and *serous effusions* generally. The liquid which they cause to be discharged from the intestinal canal is speedily replaced by that which is absorbed from the cavity in which the effusion exists, and thus by degrees the whole of the morbid collection may be evacuated. Whether this effect will be curative or only palliative must depend upon the character of each case. In general, when the cause of the effusion is a permanent organic change, the purgative is only of a temporary advantage; it may evacuate the liquid completely, but cannot prevent its reproduction. Such is the case when general dropsy depends upon organic valvular disease of the heart or granular degeneration of the kidneys, or ascites upon cirrhosis of the liver. But when, as in many cases of ascites, the affection of the spleen or of the liver is one not only curable, but by purgatives rather than by any other remedies, the evacuation of the liquid is permanent; or if not from the first action of the medicines, may become so upon their repetition. In this form of dropsy it is that the active hydragogue cathartics (jalap, elaterium, colocynth) are most useful, particularly when, in combination with salines, they succeed small doses of mercurial preparations. In other forms, as pericardial and pleuritic effusion, but especially in general dropsy produced by cold, purgatives alone are less advantageous than diuretics, but the two in alternation are more efficient than either alone.

The evacuant and revulsive operations of cathartics form a most precious resource in many affections of the *brain*, and in some of the *spinal marrow*. At the commencement of inflammatory affections of the former organ, a full dose of calomel, followed by a saline sufficient to produce copious watery evacuations, is a means of materially mitigating the violence of the subsequent course of attack; but it is one which is not so well adapted to persons of a delicate constitution, nor to children, as it is to robust adults. These medicines, and even the most powerful drastic cathartics, such as croton oil, are strongly indicated in *congestion of the brain*, whether it arise from a plethoric condition and over-excitement of this organ, or from an imperfect evacuation of the bowels, or the presence within them of some indigestible substance. Even when paralytic symptoms render probable the existence of an effusion within the

cavity of the cranium, they, along with moderate depletion, are best adapted to promote its absorption, provided they be not carried to the extent of exhausting the patient. In the beginning, saline cathartics are the most appropriate; but subsequently a regular evacuation, at intervals of two or three days, by means of jalap or of the compound cathartic pill, will be found more effectual. Congestion of both of the central organs of the nervous system, and a consequent impairment of their functions, are common effects of constipation, and may be relieved by the same agents which are fitted to remove this condition.

Purgatives influence *uterine disorders* partly by their deobstruent and partly by their stimulant properties; by the former when habitual constipation is present, and with it a congested state of the whole venous system of the abdomen, as indicated by hæmorrhoids, derangement of the hepatic functions, etc.; and by the latter when, instead of this special infarction, the abdominal organs fail in their functions from a deficiency rather than an excess of blood in their vessels. In the one case any of the evacuant remedies will probably fulfil the indication presented; in the other those which especially stimulate the lower part of the bowels—the resinous cathartics in general, and aloes in particular.

Affections of the *respiratory organs* are not in general favorably influenced by cathartics, except in so far as a state of plethora may be present, or when the disease is in its forming stage. In the former condition their depletory action is important as a palliative, and in the latter it sometimes prevents any further development of the attack. Saline cathartics are only to be preferred in such cases, when there is a decided febrile reaction; but for bringing about resolution, promoting expectoration, and allaying the painful irritation of acute inflammations of the bronchial mucous membrane, no remedy is comparable to castor oil.

The use of purgatives in *chorea* is not of recent introduction into medicine, since it was recommended by Sydenham and De Haen, and more lately by Hamilton and Bardsley. In case of pure and uncomplicated chorea occurring in robust children, it is very probable that medicines of this class will often accomplish a cure, but in many others, and, as we believe, in a majority of the whole, a really curative plan must be tonic rather than debilitant. But it is a peculiarity of this disease that the bowels are very torpid, and the dejections are often very dark and fetid; and it is probable that this circumstance first suggested the employment of cathartics for its cure. Those which have been most successfully employed belong to the drastic division, and comprise calomel and jalap, scammony and aloes, and should be given at intervals of two or three days, according to the nature of the evacuations and the degree of improvement obtained.

Several *diseases of the skin* are benefited by a judicious and persevering use of purgatives. Eczema and impetigo, at the decline of the acute stage, are sensibly moderated by saline laxatives, particularly when administered in conjunction with bitter vegetable in-

fusions; and lepra, if not inveterate, is improved by these and by the more drastic articles, such as jalap and aloes.

In general terms, the selection of a purgative should be determined by the character of the effect which it is intended to produce. The salines are adapted to a prompt and thorough evacuation of the bowels, with the advantage of acting as depletory agents. Croton oil is also speedy in its operation, and is at the same time powerfully revulsive. On the other hand, a slower but equally decided influence is exerted by the resinous cathartics and by castor oil, either alone or given subsequently to the adminstration of calomel. When acidity of the stomach and bowels prevails, magnesia is preferable to all the other agents of its class. If the biliary secretion is deficient, mercurials are supposed to render it more abundant, and if, on the other hand, it is excessive and altered in quality, the same medicines, by increasing its flow and at the same time tending to evacuate it from the bowels, are still regarded as the most appropriate remedy.

The association of different purgatives in the same dose is an ancient practice, and was intended to promote, by a single medicine, all of the secretions of the intestine and its greater glands, but especially the mucus, the serum, and the bile. Thus, in dropsy dependent upon hepatic derangement, rhubarb and aloes, which were believed to excite the secretion of the liver, were combined with jalap as a hydragogue, and senna as a phlegmagogue medicine. At the present time, the same method is universally employed, with the difference that mercurials take the place of rhubarb and aloes. The popular purgative, composed of senna, manna, and Epsom salts, the "black draught" of the British Pharmacopœia, is a combination of similar intent and operation. In these associations, as Mialhe has remarked, the effect produced upon particular portions of the economy is to be regarded more than the abundance of the evacuation which takes place. Compound cathartics are more useful than a single one, not only because they purge more actively, but because they act upon several organs at once. When calomel and jalap are administered together, the former acts upon the whole intestinal canal, but chiefly upon the upper portion; the jalap is for the most part dissolved by the alkaline secretions of the large intestine which it purges, while it carries off the calomel which remains undissolved.

The proportion of water taken with or after certain purgatives, influences their operation. Saline laxatives are most prompt and thorough in their effects when largely diluted. In this case the bulk of the medicine contributes to its effects, and at the same time moderates its irritant impression. If given in a small quantity of liquid, a full dose of Epsom salts will generally fail of its intended effect, and sometimes occasion burning pains in the abdomen. In cases for which magnesia is peculiarly indicated, that is, when there is an acid condition of the alvine secretions, too large a quantity of water interferes somewhat with its combination with these acids, and consequently with its purgative effect. A similar re-

mark is applicable to mercurial cathartics. In general, with the exceptions already indicated, purgative medicines act more promptly when a moderate quantity of liquid accompanies them in their passage through the bowels; too little delays their progress and their solution, and too much prevents their exercising a due degree of irritation upon the mucous membrane.

As the presence of food in the alimentary canal must interfere more or less with the action of the purgative medicine, it should generally be administered upon an empty stomach. This rule is peculiarly important in the case of saline medicines, and hence it is customary to prescribe them to be taken early in the morning; but resinous cathartics, which are slower in their operation, are given with more advantage at bedtime. The same hour is appropriate for the administration of mercurials; and in the morning they may be followed by a saline draught.

When it is desired not to exceed a moderate purgative effect, it is most prudent to administer the proper medicine in divided doses, at intervals of one, two, or three hours, or to associate with it a narcotic such as hyoscyamus, which will moderate its action without impairing its purgative power. Opium may be employed for the same purpose; but it is too apt to interfere with the cathartic operation. When calomel is given in cases attended with large or frequent evacuations, this combination is of great value. Purgatives which gripe because they create flatulence, may have their action favorably modified by associating with them a carminative, as anise or caraway seed; and the irritation of drastic medicines may be moderated by the free administration of diluent and especially of mucilaginous drinks, after this symptom has begun to manifest itself. The same liquids are very serviceable in allaying the gastric and intestinal irritation produced by the harsher purgatives. Bitter tonics are often associated with cathartic medicines, particularly when a necessity exists for their repeated use, and when the former agents are not contraindicated by the presence of a febrile or inflammatory state. In the treatment of habitual constipation, this combination, while augmenting the power of the cathartic medicine, prevents it from rapidly exhausting the susceptibility of the bowel, and requiring a repetition of the purgative dose.

Cathartic Enemata.—An operation of the bowels can be produced by any of the agents of the present class, introduced into the large intestine through the anus. As in the case of the same medicines administered by the mouth, they may operate by their bulk, their temperature, or their intrinsic stimulant or irritant properties, and in some degree also in consequence of their absorption. According to the experiments of Falck,[1] the more the temperature of a clyster of pure water is above or below that of the body, and the greater its bulk, the more apt it is to produce a purgative effect. To fill the colon of an adult, three or four pints of liquid are neces-

[1] Archiv für phys. Heilkunde, x. 765.

sary, and there is reason to believe that a portion of it may pass through the ileo-cæcal valve. This is not, however, ordinarily the case, and hence this valve used to be called by the French *la barrière des apothicaires*, or the apothecaries' barrier, in allusion to the custom of employing apothecaries to administer enemata. The habitual use of such large enemata is accused, and probably with justice, of producing permanent dilatation as well as atony of the colon. But there can be no objection to using them occasionally.

The advantages of evacuant enemata over purgatives by the mouth are several, but they are chiefly confined to cases in which it is desirable to avoid irritating the stomach or interfering with digestion, and those in which the object in view is either to evacuate the lower bowels, or to employ their mucous membrane as a surface upon which a salutary derivation may be made. All medicines of the purgative class, except calomel, may be made use of in this manner, and consequently all degrees of stimulation may be applied to the colon by their means. The same laws respecting the absorption of medicinal substances obtain in this as in the other case, and consequently the effects of enemata depend in part upon their local irritation, and in part upon their absorption and subsequent elimination from the glands and bloodvessels of the colon.

The simplest enema is water. It is the one most frequently used in France, where this mode of producing evacuation of the bowels is more common than elsewhere. This is probably due to the universal and habitual use, by all classes of the people, of coffee and astringent wines, of eating a large proportion of bread and a small one of vegetables, and of taking but two meals in the twenty-four hours. In that country the habit of obtaining this artificial relief frequently supplants entirely the calls of nature, so that the bowels are never open unless an enema is made use of. Examples of the same nature are occasionally met with in the United States. If instead of employing cold water—which is the only safe liquid for habitual use in this manner—warm water, either alone or with soap, salt, oil, lard, sugar, or molasses, is injected into the bowel, very serious consequences may result. The natural protective mucus is removed, the lining membrane of the intestine is irritated, and gradually the fæces become more and more scybalous, and the formation of hæmorrhoids or fistula in ano almost certainly ensues.

But, as occasional remedies in disease, enemata cannot be too highly esteemed. It frequently happens that the condition of the stomach or small intestine peremptorily forbids or renders inexpedient the administration of purgatives by the mouth; or that the patient is unable or unwilling to swallow them; or that, as already remarked, the stimulant or derivative action of a purgative upon the colon is sufficient to fulfil the curative intention. In all such cases an enema of the proper quality, and properly administered, is greatly to be preferred before other means of evacuating the bowels.

Enemata are not officinal in the United States Pharmacopœia, but the following are those ordinarily employed:—

ENEMA ALOES.—*Enema of Aloes.*

Aloes, *two scruples;* Carbonate of Potassa, *fifteen grains;* Barley Water, *half a pint.*

ENEMA ASSAFŒTIDÆ.—*Enema of Assafetida.*

Tincture of Assafetida, *six fluidrachms;* Mucilage of Starch, *six fluidounces.*

ENEMA CATHARTICUM.—*Cathartic Enema.*

Olive Oil, *one ounce;* Sulphate of Magnesia, *half an ounce;* Senna, *half an ounce;* Boiling Water, *sixteen fluidounces.* Infuse the senna for an hour in the water; then dissolve the salt and sugar; add the oil, and mix them by agitation.

ENEMA COMMUNE.—*Common Enema.*

Common Salt, *an ounce;* Warm Gruel or Barley Water, *twelve ounces.* Oil, lard, or molasses may be added. Epsom or Glauber salts may be substituted for common salt in this preparation.

ENEMA COLOCYNTHIDIS.—*Enema of Colocynth.*

Extract of Colocynth, *half a drachm;* Soft Soap, *an ounce;* Water, *a pint.* Mix and rub together.

Aperient enemata, which are at the same time emollient and demulcent, may be made of mucilage of flaxseed, an infusion of slippery elm bark, a decoction of rice, or barley, or oats; or, if a stimulant operation is required, it may be procured by means of oil of turpentine or assafetida, the former made into an emulsion with mucilage or the yelk of egg, and the latter with mucilage or water.

It is of the utmost consequence to the success of enemata that they should be administered slowly, and with occasional remissions of the propulsive force, so as to allow the liquid to diffuse itself over the large intestine. This is peculiarly necessary when the bowel is obstructed with fæces. The patient should lie upon the left side at the commencement of the injection, afterwards upon the back, and ultimately upon the right side, so that gravity may favor the diffusion of the liquid throughout the intestine. The first tendency to expel it should be steadfastly resisted, and the patient's effort to do so seconded by applying a folded napkin, and pressing it firmly against the anus.

Purgative *suppositories* were employed by Hippocrates, composed of honey, soap, salt, nitre, and powdered colocynth. Although these agents were generally applied in the vagina for the cure of uterine affections,[1] they were also, as in modern times, sometimes introduced in the rectum, and directed to be of a spherical and sometimes of a conical, oblong, or oval shape. They act partly by mechanical irritation, and partly by their purgative virtues. Dr. Osborne found assafetida, elaterium, and croton oil, associated with soap, to act freely when employed in this manner;[2] but croton oil, on account of its extremely irritating properties, should not be

[1] Ed. Fæsii, i. 265. [2] Dublin Quart. Journ., xvi. 473.

used except when the necessity of procuring an evacuation of the bowels is unusually urgent. A very efficient laxative suppository, and one much used by nurses and the poorer classes when constipation affects infants, consists of a piece of brown soap about an inch in length and half an inch in diameter. But its repeated use irritates the anus, and renders the constipation more obstinate. In all cases the suppository should be introduced beyond the grasp of the sphincter ani. It may be carried to its place by means of the finger, previously anointed, or by means of a glass or vulcanized India-rubber tube open at both ends, and furnished with a piston.

The only officinal purgative suppositories are—

SUPPOSITORIA ALOES. *Suppositories of Aloes.*—Each suppository contains five grains of aloes and twenty-five grains of oil of theobroma.

SULPHUR LOTUM.—WASHED SULPHUR.

SULPHUR SUBLIMATUM.—SUBLIMED SULPHUR.

Description.—Sulphur is a simple substance which is very widely diffused in nature. It exists in a more or less pure state, or combined with metals, in the mineral kingdom, and enters into the composition of albuminous or protein substances. It is most abundant in volcanic regions. The crude sulphur of commerce is chiefly obtained by fusing native sulphur or by roasting native sulphurets. By heating this product *sublimed sulphur* is obtained, which, when thoroughly freed from acidity with hot water, forms the officinal preparation. *Washed sulphur* is a crystalline powder of a fine yellow color, which has a slight taste, and by friction exhales a perceptible smell. *Precipitated Sulphur* (SULPHUR PRÆCIPITATUM) is formed by boiling sulphur and lime together until they combine, and then adding muriatic acid, which forms a soluble chloride of calcium and precipitates the sulphur. It is a soft, light powder, and is known as *milk of sulphur*.

History.—The name of this substance is derived, according to some, from *sal*, salt, and πυρ, fire; and, according to others, from *solum*, earth, and πυρ.[1] The synonymous word brimstone is derived from *byrne*, burning, and *stoan*, stone.[2] The earliest mention of sulphur is contained in the account given of the destruction which overtook the cities of the plain by "fire and brimstone."[3] In the Odyssey, Homer describes the use of its fumes to purify dwellings. Hippocrates mentions sulphur (θειον) several times in his treatise on the diseases of females. Pliny alludes to several varieties of it and the sources whence they were obtained.[4] One of these only, which he describes as being clear and of a greenish tint, is said by him to be employed in medicine. He attributes to it a heating

[1] ALSTON.
[2] BAILEY.
[3] Genesis, xix. 24.
[4] Lib. xxx. 50.

and maturating quality, and states that it discusses swellings, and for that purpose forms an ingredient of plasters and poultices. An ointment made with it and rubbed upon the loins is, he adds, very serviceable in lumbago. In combination with resins, it removes lichenous and leprous eruptions from the face. As an electuary, it relieves dyspnœa and cures coughs with purulent expectoration. It communicates its virtues to thermal springs. Among the Romans as among the Greeks the fumes of sulphur were in general use for purifying bodies, clothing, and places. Dioscorides[1] gives almost the same account as Pliny, but dwells more particularly on the use of the medicine in cutaneous diseases, and especially in the itch. Galen copies the statements of his predecessors. Paul, of Egina, speaks of it as a "wonderful remedy for scabious complaints."[2]

Action. *On Animals.*—Benk found that in dogs sulphur occasioned anorexia, thirst, and diarrhœa. The animal temperature at first was raised, but afterwards it fell below the natural standard; at first, too, the pulse was more frequent, but subsequently became slower than usual; there was also embarrassed breathing, slight general trembling, convulsions, and sudden death. The effects of sulphur upon cats were nearly the same, but with the addition of vomiting, general emaciation, debility, and coma. After death, the stomach and intestines were found very much injected.[3] According to Hertwig,[4] small and occasional doses of sulphur display no peculiar effects upon animals, but the effect of somewhat larger and repeated doses is to impregnate the perspiration, the eructations, the dung, and sometimes the expired breath with the odor of sulphuretted hydrogen, while the pulse remains unchanged, as well as the cutaneous and mucous secretions, and the appetite becomes stronger. Still larger doses augment the secretion of intestinal mucus and procure abundant and semi-fluid dejections, but do not destroy the appetite. Very large doses are said to cause inflammation of the gastro-intestinal mucous membrane, which, however, is superficial, and unattended with any violent symptoms.

A nine years old horse, of medium strength, and affected with the glanders, had given him an ounce of sulphur the first day, two ounces the second, etc., so that by the sixteenth day he had taken one hundred and thirty-six ounces. Diarrhœa set in upon the seventh and continued until the seventeenth day; the appetite was not diminished, nor the secretion of urine changed; the cutaneous secretion was not augmented, but after the third day had a sulphurous smell, and, by blackening a paper wet with a solution of sugar of lead, was proved to contain sulphur. The other symptoms which the animal manifested might very well have arisen from the disease under which he labored. On the seventeenth day he was killed. The mucous membrane of the stomach and bowels was reddened and softened, and their cavity contained a large quantity of sulphur. The flesh of sheep that had had sulphur mixed with

[1] Lib. v. 83.
[2] ADAMS's Comment., iii. 185.
[3] GIACOMINI, Mat. Med., p. 312.
[4] WIBMER, Wirkung, etc., v. 278.

their food was found to taste and smell so strongly of sulphuretted gas as to be unfit for the table.

On Man.—When applied without friction to the sound skin it exerts no sensible action, but when excoriations or ulcers exist, or the chorion is already inflamed, sulphur acts as a mild irritant. Internally, in doses of five or six grains, it produces no sensible phenomena, but when twenty grains, or from that to forty grains are taken, it creates some movement in the abdomen, and a loose discharge from the bowels, without colic. At the same time whatever flatus escapes has the characteristic odor of sulphuretted hydrogen. But the greater part of the sulphur is passed unchanged. When doses of twelve grains or more are repeated at intervals of an hour or two, their action is said to be displayed by a higher temperature of the skin, and by increased perspiration and frequency of the pulse.[1] The skin exhales a sulphurous smell, and silver articles allowed to remain in contact with it are blackened. It has happened, when a course of mercury has followed the administration of sulphur, that parts of the skin have turned black from the formation of sulphuret of mercury.[2] The expired air, the urine, and the milk, have also revealed its presence by their odor, or by the use of chemical reagents. Vogt observed that when taken for a long time, it gives a peculiar tint to the skin, and Hahnemann noticed brownish spots and other ephemeral cutaneous eruptions from its use.[3] If, according to Mitscherlich,[4] the patient is plethoric and impressionable, or is suffering under an inflammatory disease, sulphur is apt to cause excitement of the circulation, and feverishness. The stools, in general, are semi-liquid, a circumstance peculiar to the laxative operation of sulphur. In some cases the medicine occasions a sense of extreme anxiety and depression, which ceases upon the free discharge of fetid gas from the bowels, and is therefore thought to depend upon the action of sulphuretted hydrogen.

Some cases of almost poisonous effects, attributed to this substance, are recorded. One is related of a person who took 120 grains of sulphur with wine four or five times a day. On the sixth day he was seized with nausea, bloody diarrhœa, cramp in the muscles of the legs, fever, dysury, etc. For several years his stomach remained irritable.[5] Another is recorded by Prof. Olmstead, of New Haven, of a man who, for the cure of rheumatism, took, in all, six pounds of sulphur.[6] His ordinary dose was half an ounce three times a day. Although the limbs grew distorted and thinner, and the joints stiffer and more swollen by the progress of the rheumatic disease, it does not appear that the digestive organs suffered any of that derangement which occurred in the other case referred to, and which may very probably have depended upon

[1] Barbier, Mat. Med., ii. 244.
[2] Headland, On the Action of Medicines, p. 289.
[3] Giacomini, loc. cit.
[4] Lehrbuch, etc., ii. 439.
[5] Wibmer, op. cit., v. 277.
[6] Strumpf, Handbuch, from Silliman's Am. Journ. of Science, viii. 394.

some other cause than the sulphur, perhaps upon the presence of sulphuric acid in the parcel that was used.

Uses.—The most important application of sulphur is as a remedy for *scabies*. The ancient custom of treating this disease by sulphur, which has already been adverted to, continues at the present day. The principal modifications which modern physicians have introduced into the method have arisen from the recognition of the complete inutility of sulphur as an internal remedy for itch, and from the discovery of the itch insect (*acarus scabiei*) whose destruction by its means constitutes the cure of the disease. These two points having been settled, the use of the remedy became simplified, and the time necessary for its effecting a cure was singularly abridged. As long ago as in 1812–13 Helmerich, and also Burdin, cured the itch, the one in eighteen hours, and the other in about half that time, by means of vigorous and repeated frictions with sulphur ointment aided by warm baths.[1] Subsequently, however, the principle upon which this method became effectual having been lost sight of, the method itself fell into disuse, and the itch continued to require an average period of twelve days for its cure. Within the last few years this neglected plan of treatment has been revived, and with most surprising results. Some of these were set forth by Prof. Hebra, of Vienna, in 1844,[2] and we have since then had an opportunity of witnessing them in the General Hospital of that city. Dr. Hebra made use of the following ointment: ℞.—Cretæ, ℥iv; sulphuris, picis liquidæ, āā ℥vj; saponis communis, axung. porci, āā ℔j.—M. This quantity is sufficient for twenty persons. The chalk in the ointment is intended, by acting mechanically, to destroy the burrow in which the acarus lodges; the sulphur kills the insect, and the lard, soap, and tar give the preparation a proper consistence. After the patient has taken a tepid bath, his skin is carefully examined, in order to discover, if possible, any burrows elsewhere than upon the hands. All the parts on which they are detected are then briskly rubbed with the ointment, and the frictions are repeated twice daily. In three days the cure is complete. A similar method, and with like success, was employed by M. Bazin, of Paris. He made use of Helmerich's ointment, composed of two parts of sulphur, one of carbonate of potash, and eight of lard.[3] M. Hardy afterwards perfected the method so as radically to cure the disease in *two hours*. He proceeded in the following manner: The patient first underwent a friction of his whole body for half an hour with soft soap, in order to cleanse the skin and break up the burrows; a warm bath of an hour's duration followed, during which the skin was thoroughly rubbed in order to complete the destruction of the burrows; after which frictions for half an hour, and upon the whole surface, were practised with Helmerich's ointment. This completed the cure. Out of four hundred patients subjected to this treatment four only

[1] Bull. de Thérap., xlvi., 238.
[2] Annales des Mal. de la Peau, ii. 112.
[3] Bull. de Thérap., xxxix. 137.

returned to the hospital.[1] Subsequently Hardy employed a milder ointment composed of one part of carbonate of potassium, two parts of sublimed sulphur, and twelve parts of lard. In private practice it is usually sufficient for the patient to take a prolonged warm bath in the evening and be rubbed with the ointment, and on the following morning to undergo another friction. The ointment is not removed until the evening, when a second warm bath is taken for this purpose.[2] It is probable that such thorough frictions, applied only to certain parts of the body, as Hebra recommends, would prove quite as effectual and be much less vexatious. By the method of Dr. Bourguignon, a Belgian physician, the same result is claimed to have been produced in *half an hour*. He made use of a liquid prepared by boiling one part of quicklime with two parts of sublimed sulphur in ten parts of water, until the two former were perfectly united. During the boiling it was constantly stirred with a wooden rod, and when the sulphur and lime had combined the fluid was decanted and kept in a well-stoppered bottle. A pint is enough for the cure of several cases. It is sufficient to wash the skin well with warm water and then to rub the liquid into it for half an hour. As it evaporates a layer of sulphur is left upon the skin. During the half hour the acarus is killed, and the patient is cured.[3] Experience has shown that these rapid methods of treatment of scabies are very apt to aggravate the concomitant eruptions of the skin (eczema, etc.), and when the integument is delicate to excite such eruption. It is desirable therefore to confine the frictions to parts upon which the disease is certainly scabies, and especially to the hands and wrists, while soothing astringent ointments are applied to other eruptions.

Sulphurous *fumigations* were long ago employed by Glauber and by J. P. Frank, who may perhaps have had the plan suggested by a custom which prevails among the inhabitants of the Solfaterra in Italy, of employing the sulphurous vapor which there issues from the earth for the cure of various diseases. More recently, Galés in Paris, Clarke, Wallace, and Bardsley[4] in England, and Emerson in Philadelphia,[5] made use of a similar method. The forms of disease in which it was employed are *chronic eczema*, *psoriasis*, *impetigo*, and *prurigo*, *rheumatic* and *scrofulous* affections, *paralysis*, *amenorrhœa*, etc. In many instances the plan was successful, but the accidents which it sometimes occasions probably led to its neglect. These are, according to Rayer,[6] irritation of the skin, great debility, syncope, suffocation, etc., effects which would render the method dangerous if indiscriminately used.

Sulphur *baths*, particularly those of natural *thermal* springs, are much safer, as well as more efficacious. In Europe these springs are numerous; they do not, it is believed, exist in the eastern por-

[1] Bull. de Thérap., xli. 180. [2] Ibid., lxxv. 88.
[3] Association Med. Journ. and Phil. Med. Exam., July, 1856, p. 447.
[4] Hospital Facts and Observations, p. 192.
[5] Phil. Journ. of Med. and Phys. Sci., iii. 126.
[6] Mal. de la Peau (éd. de Brux.), p. 38.

tions of the United States; but they abound on the western slope of the Rocky Mountains and near the Pacific coast. With intelligent management, however, the cold sulphur waters of Virginia and New York might be rendered more useful than they now are in cutaneous and rheumatic affections, etc. The action of warm sulphur baths is thus described by Rayer.[1] After using them for several days, some of these waters produce an eruption of small, red, acuminated, pruriginous elevations, and of red spots, which appear first upon the limbs, but soon spread to nearly the whole surface of the body; a febrile movement, with thirst and loss of appetite, is developed; the sleep is restless; the urine is cloudy and muddy. In from one to two weeks these symptoms disappear in the order of their coming, the epidermis separates in branny scales, but the skin continues to itch for some time longer. The same writer gives much credit to the use of lotions and douches of sulphurous waters in some local cutaneous affections, and especially in that intractable and disfiguring complaint, *acne rosacea.* Sulphur is also recommended by Dr. James Morris, whose mode of employing it is as follows: sixty grains of sulphur are pulverized with alcohol, twice as much precipitated sulphur is then added, and afterwards enough distilled water to render it sufficiently liquid for use. This is smeared over the face freely at night, and more sparingly in the morning; the effect is generally very soon apparent, and is often most striking.[2]

Sulphur has enjoyed considerable reputation in the treatment of *rheumatism;* and probably in that form of it which affects the muscles and the tendinous expansions it may be curative through its diaphoretic action. Van Swieten, Hufeland, Cheyne, and many others, have maintained its efficacy. But they generally associated it with medicines of much more decided and established powers. The external application of dry sulphur, with friction and bandaging with flannel, has been used successfully by Dr. O'Connor in *sciatica* and *chronic rheumatism,*[3] and Gieseler states that repeated frictions with sulphur ointment, followed by the application of a flannel bandage, are very efficient in the cure of *muscular rheumatism.*[4] The sulphurous *vapor bath* is one of the most efficient of all the remedies for inveterate rheumatism, particularly when followed by a cold douche of sea or sulphurous water. It is also of use in the treatment of *albuminuria,* its influence being more permanent than that of moist heat alone.

In *chronic coughs,* with profuse expectoration, its virtues are sometimes conspicuous. This is the only form of pulmonary affection in which it is appropriate, yet many writers have vaunted it in phthisis, whooping-cough, and even in pleurisy.

As a *laxative,* sulphur is appropriate when the object is chiefly to empty the bowels without exercising an antiphlogistic action.

[1] Mal. de la Peau (éd. de Brux.), p. 87.
[2] Lancet, March, 1855, p. 237.
[3] Ibid., Feb. 1857, p. 184.
[4] Journ. f. Pharm. Tox. u. Therap., ii. 227.

The quality it possesses of accomplishing this purpose renders it a valuable palliative in *piles*. It has also been thought to promote the *menstrual discharge* when it is scanty, to relieve *congestion of the liver*, to expel *intestinal worms*, and to cure a variety of chronic affections which depend more or less directly upon constipation of the bowels. It is popularly employed as a laxative, in the spring season, to "purify the blood."

Administration.—Sulphur is given as a laxative in the *dose* of from 60 to 240 *grains*. For other purposes the dose is about 30 grains. It may be administered in milk, or with molasses or some other syrup.

MAGNESIA.—MAGNESIA.

Description.—Magnesia combined with various acids exists in the mineral and vegetable kingdoms, and as a product of urinary disease in man. It is prepared from carbonate of magnesia by calcination. It is usually a light, fine, white, and inodorous powder with a faint earthy or alkaline taste. By some methods of preparation it acquires a density four times as great as that of ordinary calcined magnesia. It is almost insoluble in water, but is less so in cold than in hot water. It was thought to be insusceptible of fusion until it was melted by the compound blowpipe of Dr. Hare. When stirred with water and then allowed to stand, it becomes hard by a partial conversion into a hydrate.

History.—Our acquaintance with magnesia is not of earlier date than the commencement of the eighteenth century, when it was vaunted as a panacea under the name of *Count Palma's powder*. For its introduction into the materia medica we are indebted to Lancisi in 1717, and to Hoffmann in 1722. The latter states that its reputation while a secret remedy was gained by the relief it afforded hypochondriacal persons, and those who suffered from acidity of the primæ viæ.[1] In 1773 Mr. Henry recommended the calcination of magnesia as rendering in a fitter medicine in certain cases; and the preparation was soon afterwards introduced into the British Pharmacopœias, under the name of *magnesia usta*.

Action.—The action of magnesia upon the bowels is more or less distinct according to the quantity of acid which they contain, by means of which it is converted into a neutral and purgative salt. Hence its operation is generally quickened by acidulous drinks, such as lemonade. By absorbing the acids which it encounters in the stomach and intestine, it prevents the consequences of their local irritation as well as their return into the system. When enough acid is not contained in the alimentary canal to combine with all of the magnesia taken, a portion of the latter is apt to be retained. Hence it has happened that when magnesia has been

[1] Op. Omnia, iv. 479; Animadversiones et Experimenta circa Magnesiam albam, etc.

used daily or at short intervals for a long time, it has formed considerable masses by its union with the intestinal mucus and indigestible articles of food, and quite obstructed the passage of the bowel. Two such cases are quoted in many treatises upon the materia medica, in one of which not less than nine or ten pounds of magnesia had been taken in the course of two years and a half; but the fact that these instances appear to be almost the only ones upon record shows that the mischievous effect alluded to must be extremely rare. Magnesia is capable of destroying the acidity of the urine when taken for some time, and may even reverse its quality and cause a deposit of the earthy phosphates in the form of white sand.

Uses.—Magnesia has an advantage over nearly every other laxative, in being almost insipid and rarely causing sickness at the stomach or colic. It produces feculent discharges, and hence it does not weaken as much as the neutral salts. The dejections are also remarkable for having very little smell. It is slow in its operation, and generally requires six or eight hours, and sometimes a longer time, to produce its effects. In some experiments on the comparative powers of magnesia and Glauber salts, Trousseau found that 60 grains of the former, although it acted more slowly, still produced more evacuations than an ounce of the latter. The neutral salt, also, when given for several successive days, became less active every day, while the magnesia, on the contrary, grew more so, and produced mucous and even bloody stools, with tenesmus. Similar comparisons instituted by Dorvault, between magnesia, the sulphate, and the citrate of magnesia, show the first-named purgative to be the slowest and the mildest of the three.[1] Some experiments of Cless coincide exactly with those of Trousseau.[2]

In most of the forms of derangement of the digestion attended with *acidity of the stomach*, magnesia is a useful palliative. It has even arrested the *vomiting of pregnancy*, when the rejected fluid was strongly acid.[3] In all cases of *sour stomach*, *heartburn*, *colic*, *sick headache*, *mental depression*, etc., which are accompanied with constipation, this medicine affords great relief, but its use must alternate with that of tonics, and be sustained by a strictly regulated diet, active exercise, and the absence of mental anxiety, to be permanently beneficial. As a laxative, it is frequently used in diseases of children arising from improper food, sometimes alone, and sometimes combined with rhubarb. It is a very appropriate agent for evacuating the bowels in piles and other affections of the rectum. When it is less active than desired, the addition of Epsom salts renders it more efficient. This combination, with wine of colchicum, forms a very eligible prescription in gout and its allied disorders, as in the following formula: ℞.—Magnesiæ sulph. ℥j-ij; aq. menthæ, f℥x; acet. colchici, syrupi simpl., āā f℥j; magnesiæ, gr. clx.—M. S.—One to three tablespoonfuls every two hours until

[1] Bull. de Thérap., xl. 406. [2] CANSTATT's Jahresbericht, f. 1853, p. 145.
[3] WATSON, Med. Obs. and Inq., iii. 325.

from four to six evacuations are produced in the twenty-four hours. In *colic*, particularly the flatulent variety to which infants are subject, it should be associated with some aromatic or anodyne, as in the carminative mixture of Dewees: ℞.—Magnesiæ, gr. xxx; tinct. assafœtidæ, gtt. xl; tinct. opii, gtt. xx; sacch. alb. gr. lx; aquæ, f℥j.—M. S.—Twenty drops and upwards.

It was early noticed that magnesia checks the formation of *acid gravel*. Hoffmann thought it the best of antilithics. Its virtues in this respect were demonstrated by Brande in 1813. It has been supposed by some to be superior to the alkaline carbonates in lithiasis, both because it is thought to be less apt to derange the general health by its absorption into the blood, and because its laxative action promotes the elimination of injurious elements from the economy. But in practice this opinion is hardly sustained.

Numerous cases may be found recorded in which magnesia has appeared to act as an antidote to *arsenical poisoning*, but, as observed by Orfila,[1] the cases are not conclusive; because in all of them vomiting took place after the magnesia was administered, and consequently a large portion of the poison may have been rejected. In experiments on animals it was found, by this toxicologist, that when magnesia was given along with, or directly after, arsenic, death was nevertheless the result if vomiting was prevented by ligature of the œsophagus. Besides, arsenite of magnesia is itself poisonous, although less so than arsenious acid. Schroff remarks, that magnesia acts as an antidote to arsenic or arsenious acid only when the latter is not introduced into the stomach in solution, for the soluble preparations of arsenic are too rapidly absorbed to be arrested by any chemical antidote.[2] Magnesia may be used as an antidote to poisoning by *acids* and by *phosphorus*. In the latter case, calcined magnesia suspended in boiled water, and freely administered, is recommended by Antonielli and Borsarelli, as the best antidote, and the most appropriate purgative for eliminating the poisoning.[3]

Cases of *diabetes mellitus* cured by magnesia have been published from time to time. Eberle found it successful in a mild case of long standing.

Administration.—The *purgative* dose of magnesia is about *forty grains* for adults, and *five grains* for infants. As an *antacid*, it may be taken in doses of *ten grains* and upwards twice a day. It may be given in water or milk.

MAGNESII CARBONAS.—CARBONATE OF MAGNESIUM.

Description.—This substance is prepared by decomposing sulphate of magnesium with carbonate of potassium. Its *physical pro-*

[1] Toxicologie, i. 447. [2] Brit. and For. Med.-Chir. Rev., April, 1859, p. 518.
[3] Bull. de Thérap., lv. 524.

perties are almost identical with those of magnesia. It is, however, even less soluble than that substance in water. Its *uses* are the same as those of calcined magnesia, but it is less active. When sickness at the stomach is present, the carbonate is, perhaps, to be preferred in consequence of its evolving carbonic acid, but in general this quality is a defect, inasmuch as it is apt to cause undue distension of the alimentary canal. Under the title "Sir James Murray's fluid magnesia," a very excellent laxative is employed. It consists of a solution of pure bicarbonate of magnesia in carbonated water. The liquid sold as effervescing citrate of magnesia is very uncertain in its operation, sometimes producing no purgative effect whatever, and again operating with extreme harshness and persistency.

Several persons have called attention to the action of this substance when taken internally, in removing *warts* from the skin.[1] The numerous cases of its complete success in destroying these unsightly excrescences render it well worthy of being more extensively tried. The dose of the medicine for this purpose is a teaspoonful morning and evening, continued for five or six weeks.

Administration.—The dose of carbonate of magnesium as a *laxative* is from 30 to 120 *grains;* as an *antacid*, from *five to twenty grains.*

MAGNESII SULPHAS.—Sulphate of Magnesium.

History and Description.—This salt bears a variety of names derived from the places which furnish it, as Seidschütz, Püllna, and Seidlitz, in Bohemia, and Epsom, in England. It has also been known as *sal amarum*, *sal catharticum*, *sal anglicum*, etc. It was originally procured from the Epsom Spring, but was afterwards found to be extremely abundant in many saline mineral waters and in sea water. It also occurs native, and in the United States "is found abundantly in the great caverns so numerous west of the Alleghany Mountains." Finally, it is prepared in England from the double carbonate of magnesia and lime, and in this country, near Baltimore, from the siliceous hydrate of magnesia. As found in the shops, it usually occurs in small acicular crystals, which are inodorous, colorless, and transparent, and have a bitter, nauseous, and saline taste. It dissolves in its own weight of water at 60° F., and in three-fourths of its weight of boiling water.

Action.—Sulphate of magnesium is a certain, safe, and mild purgative when duly administered. When the stomach is empty, it is also very prompt in its operation, producing copious watery dejections and generally an increased discharge of urine. Indeed, if the skin be kept cool, its action is diuretic rather than purgative, particularly when the quantity of it taken is small and very much diluted. Delicate persons, especially in cool weather, are apt to

[1] Bull. de Thérap., xlii. 553, xliii. 478, xlv. 383.

feel chilly during its operation, and exhausted after it. This refrigerant action, which it possesses in common with sulphate of sodium, renders it an appropriate purgative in febrile affections.

In large doses it sometimes occasions alarming symptoms, and what is very remarkable, purging is seldom one of them. Giacomini[1] saw two ounces taken at a single dose without producing any evacuation, but chilliness instead, with paleness, inability to move, trembling of the limbs, and repeated syncope. In another case the dose was an ounce and a half, but the same general symptoms occurred, and vomiting besides. A case is related by Christison of a boy, ten years old, who took two ounces of the salt dissolved in a teacupful of water. The same symptoms as are described above occurred; in half an hour the pulse was imperceptible, and in ten minutes more the child died without any evacuation. In all of these cases the salt was mixed with but a small quantity of water. But in a fourth case, three pints of beer drugged with Epsom salts were given to an old man who was a confirmed drunkard.[2] He was seized with violent purging, and died within forty-eight hours. After death, the lining membrane of the bowels was found to be inflamed. It is clear that the quantity of fluid in which it is taken greatly influences the mode of action of this medicine. The more largely diluted it is the more considerable are its evacuant effects. The same thing is true of all saline medicines, and is amply illustrated by the activity of natural saline waters. The proportion of mineral ingredients in a purgative dose of any one of them is quite inconsiderable.

Uses.—It is unnecessary to describe at length the cases in which sulphate of magnesium may be employed medicinally. It is taken incomparably oftener without a physician's advice than with it, and generally to overcome *constipation*, to arrest *bowel complaints* arising from irritating ingesta, and to subdue the febrile symptoms and the pain that attend the development of nearly all *inflammatory diseases*. The ordinary mildness of its action renders it a safe and efficient purgative. Sometimes it is united with tartar emetic in cases such as those referred to, either to effect a thorough evacuation of the alimentary canal, or, in addition to this, to make a strong sedative impression upon the system. It is also given in divided doses and with a small proportion of tartar emetic for the purpose of producing a sustained antiphlogistic action in inflammatory diseases of a high grade. Half a grain of the antimonial and an ounce of the saline medicine may be dissolved in a pint of water, and a wineglassful of the solution administered at intervals of three hours.

It has been advantageously employed by many persons in *dysentery*. Trousseau found it very successful in an epidemic which prevailed in 1826 in the neighborhood of Tours.[3] He daily gave a solution of about half an ounce of the salt in divided doses. Giacomini[4] made use of much larger doses, such as an ounce and

[1] Mat. Med., p. 511.
[2] TAYLOR on Poisons, Am. ed., p. 15.
[3] Archives Générales, xiv. 33.
[4] Loc. cit.

upwards at once, and with the effect of arresting all discharges abruptly. We have used this remedy in the same disease, dissolving an ounce of it in a pint of water and giving two ounces of the solution every two hours. From the commencement of its operation, the tenesmus and bloody discharges diminish; the former ceases altogether in a few hours, and the latter are exchanged for watery or feculent stools. It is probable that, to be successful, this method must be resorted to near the onset of the disease. It does not, of course, exclude opiates from the treatment. The latter may be exhibited at night in its stead, or on alternate days with the saline. The sthenic forms of the disease show the efficacy of the method most clearly.

In *obstruction of the bowels* by hardened fæces, by ileus or hernia, etc., Epsom salts ought to be tried, largely diluted and in frequently repeated doses. In *painter's colic* one of the best purgatives is sulphate of magnesium with an excess of sulphuric acid. The experiments of Orfila, Good, and Paris, says Dr. Copland,[1] seem to favor its employment, and certainly unequivocal benefit results from the practice. "But whether the benefit arises from reducing the lead to an insoluble salt, or from the operation of the sulphates in exciting the action of the partially paralyzed muscular coat of the bowels, and thereby enabling them to expel retained matter of a morbid or noxious description, cannot readily be determined."

Administration.—As a purgative, the ordinary *dose* of Epsom salts is *one ounce*, but this quantity is unnecessarily large. *One-half* of that quantity dissolved in *half a pint* of water, will generally have a full purgative effect. Still less, sixty or one hundred and twenty grains, even, will suffice for thin and sensitive persons. It has been proposed,[2] in order to correct the unpleasant taste of the medicine, to add to every one hundred and twenty grains of it in solution half a fluidrachm of diluted sulphuric acid. Provided that the acid do not attack the teeth, the method is a good one. A similar, but less acid, preparation is the solution of Epsom salts in compound infusion of roses. It is said that the addition of a little of a strong infusion of coffee to a solution of Epsom salts will completely mask its repulsive flavor. Sulphate of magnesium is frequently added to vegetable purgative infusions, and particularly to that of senna forming the so-called "black draught;" also to tonic infusions for the relief of habitual constipation. It is, however, not an eligible aperient for constant use, for it soon loses its effect, and leaves the bowels more confined than at first. When given by enema, an ounce or more may be added to a pint of warm flaxseed tea, or other appropriate vehicle.

[1] Dict. of Pract. Med. (Am. ed.), i. 440.
[2] By Henry, Edinb. Med. and Surg. Journ., xli. 48.

SODII SULPHAS.—SULPHATE OF SODIUM.

Description.—This preparation is commonly known as Glauber's salts, from the name of a celebrated German chemist of the seventeenth century, by whom its nature and mode of artificial preparation were discovered.

Next to the chloride of sodium, it is one of the most abundant of native salts. It exists as an efflorescence upon the surface of certain rocks near the sea and elsewhere, as at Ulma in Sweden, in Siberia, Italy, Switzerland, Bohemia, etc., and in the ashes of certain marine plants. It is found also in various mineral waters, particularly in those of Marienbad, Carlsbad, Cheltenham, Leamington, etc.

There are several methods of obtaining sulphate of sodium, but one of the best is by the action of sulphuric acid upon common salt in the preparation of muriatic acid. The latter having been removed, the excess of sulphuric acid contained in the residuum is neutralized with soda, and the solution is allowed to crystallize. The recently prepared salt is in oblique rhombic prisms, which are beautifully transparent (hence the salt was called *sal mirabilis*), but they effloresce upon long exposure to the air, and become covered with an opaque white powder.

Uses.—This salt may be employed in the same cases as sulphate of magnesium, but its bitter and nauseous taste renders it more repulsive, and it is therefore but little used, comparatively.

Dose.—Of the crystallized salt from *half an ounce* to *an ounce*, and of the dried salt about one-half of that quantity.

The PHOSPHATE OF SODIUM and the SULPHATE OF POTASSIUM are both laxative salts, but neither of them is much used. The former is very mild in its operation, and has a cooling, saline, and not disagreeable taste. It has been employed, upon theoretical grounds, in the treatment of *rachitis*, *cholera*, and *diabetes*, but without encouraging success. Its *dose* is from half an ounce to an ounce and a half. The latter salt is less soluble than the other saline medicines which have been noticed, but a smaller dose of it is purgative. Its action is apt to be harsh, producing colicky pain and a burning sensation in the abdomen. In several instances a fatal effect has resulted from doses of it varying from half an ounce to two ounces, and in many others it occasioned very alarming symptoms.[1] In this country it is seldom used as a purgative, nor does it possess virtues entitling it to be more frequently employed.

POTASSII TARTRAS.—TARTRATE OF POTASSIUM.

History, Preparation, etc.—This salt was first described by Lemery in 1675, under the name of *sal vegetabilis*.

[1] Compare Lond. Med. Gaz., xxxiii. 54, 124; MÉRAT and DE LENS, Dict. de Mat. Méd., v. 485; and Am. Journ. of Med. Sci., Jan. 1844, p. 88.

It is prepared by the reaction of the bitartrate with the carbonate of potassium. The latter salt parts with its carbonic acid which escapes, and receives instead one equivalent of tartaric acid from the bitartrate. A neutral tartrate of potassium results.

This salt is in the form of white crystals of a bitter and disagreeable taste. It is soluble in four parts of boiling water. In alcohol, it is nearly insoluble. As found in the shops, it is generally in the form of a white, granular powder.

Action and Uses.—It is regarded as promoting all of the secretions, and that of the kidneys in particular, when it is given in small doses and much diluted. In full doses it acts upon the bowels as a laxative. It is secreted by the kidneys as carbonate of potassium. Tartrate of potassium is used as a mild, cooling purgative in all affections requiring the employment of saline evacuants, and some writers have attributed to it a special action upon the liver and upon the portal system, but it does not appear to be more operative in these respects than other medicines of its class. It is, however, a milder purgative than the sulphates of sodium and magnesium. It may be used with advantage in all cases of venous congestion within the abdomen, including those in which the hæmorrhoidal sinuses are enlarged and discharge blood. Formerly it was much the habit to use it in combination with rhubarb, senna, or manna. By this action upon the urine it forms a suitable agent for correcting the acidity of this fluid.

Dose.—From *sixty grains to an ounce*, according to whether it is intended to act chiefly upon the kidneys or upon the bowels.

POTASSII BITARTRAS.—Bitartrate of Potassium; Cream of Tartar.

Description.—Bitartrate of potassium is contained most abundantly in grape juice, but it also exists in many other acidulous vegetable juices, and particularly in that of tamarinds. It is formed in grape juice during the process of vinous fermentation. As the proportion of alcohol generated thereby increases, the salt, which is insoluble in it, is precipitated upon the bottom and sides of the vat or cask which contains the liquor, in the form of a hard and heavy crust which has more or less of a crystalline structure. It is then contaminated with carbonate of lime and coloring and extractive matters, which have to be removed by solution, and by the action of charcoal, alumina, albumen, etc.

As imported, cream of tartar is usually in the form of white crystalline masses, but in the shops it is kept as a white powder. It has a sour but not unpleasant taste, and is gritty between the teeth. In cold water it is very slightly soluble, but in hot water much more so. It is insoluble in alcohol.

Action.—In full doses it acts as a refrigerant laxative and diuretic. The latter operation is very evident when the salt is given in small quantities and much diluted. It is apt to weaken

the digestive function, to cause flatulence, griping, and, when long continued, a decided loss of flesh. According to Trousseau and Pidoux, while other purgatives augment hæmorrhoidal and menstrual hemorrhage, it moderates and even arrests them. This statement appears to require confirmation.

In large doses cream of tartar has been poisonous. A case is reported by Mr. Tyson[1] of a man aged thirty-seven years who took four or five tablespoonfuls of this salt. He was seized with violent vomiting and purging, had pain in the abdomen, thirst, feeble pulse, and debility of the lower limbs. The fluid vomited was of a dark green color, and the stools had the appearance of coffee grounds. Death took place in forty-eight hours. On inspection, the mucous membrane of the stomach and duodenum was highly inflamed, and the whole intestinal canal more or less so.

Uses.—In *febrile diseases* attended with great heat of skin and thirst, a weak solution of this salt moderates the vascular excitement, and increases the flow of urine. The beverage called *Imperial* is an agreeable form of the medicine for this purpose. It is thus prepared: Take half an ounce of cream of tartar, a lemon, sliced, and half a pound of sugar. Add three pints of water, let it stand for half an hour, and strain. Under the same circumstances, larger doses of the medicine, and such as will produce copious watery stools, diminish the tension of the vessels and relieve the symptoms which their repletion occasions. As a *purgative*, also, it is frequently associated with sulphur, magnesia, or jalap. With sulphur it is a popular palliative for *hæmorrhoids*, and may be used for the same purpose with confection of senna. It may also be employed as a substitute for other saline laxatives in the treatment of *dysentery*, but with less advantage. With jalap it forms an efficient hydragogue cathartic, which, in some forms of *dropsy*, and in simple anasarca particularly, is rapid and decided in its action. Twelve grains of jalap thoroughly triturated with thirty of cream of tartar, constitute a certain and not disagreeable purgative. It is often associated with juniper berries in infusion (bitartrate of potassium and juniper berries, bruised, of each ℥ss, boiling water, Oj), and in the idiopathic forms of *general dropsy* few combinations are more efficient. In the form which so often occurs as a sequela of scarlatina it is of great service, either alone or associated with the tincture or the infusion of digitalis. With sulphur, it is a favorite laxative in *hæmorrhoidal affections*. With magnesia, it has been recommended in *habitual vomiting* arising from gastric acidity or from the state of pregnancy.

Dose.—As a *cathartic*, from *half an ounce* to *one ounce*; as a *diuretic*, from *sixty* to *one hundred and twenty grains* largely diluted, several times a day; or in the form of cream of tartar whey, prepared by adding *one hundred and twenty grains* of the bitartrate to *a pint* of milk.

[1] Lond. Med. Gaz., xxxi. 177.

POTASSII ET SODII TARTRAS.—TARTRATE OF POTASSIUM AND SODIUM. ROCHELLE SALT.

History and Preparation.—This salt was discovered in 1672 by Seignette, an apothecary of Rochelle; hence it is generally known as Rochelle Salt, and in France as *Sel de Seignette.*

It may be obtained by adding bitartrate of potassium to a solution of carbonate of sodium. In this process the excess of acid in the bitartrate saturates the sodium, and liberates the carbonic acid. This salt occurs in beautiful prismatic crystals which have a saline and somewhat bitter taste. It is readily soluble in cold water.

Action and Uses.—In doses of from *half an ounce* to *one ounce* it operates as a gentle and cooling laxative, and seldom disagrees with the stomach. It is particularly acceptable in the form of *Seidlitz powders*, which form an effervescing draught. In small doses it acts as an alkali upon the urine, and its vegetable constituent is digested and retained in the economy. As it is not incompatible with tartar emetic, the two agents may often be associated as an emeto-cathartic, or in smaller doses as an antiphlogistic medicine.

Dose.—As a *purgative, from half an ounce* to *one ounce.* As an *antilithic*, from sixty to one hundred and twenty grains several times a day largely diluted.

OLEUM OLIVÆ.—OLIVE OIL.

Description and History.—This is a fixed oil obtained by expression from the fruit of the olive-tree (*Olea Europæa*). This tree is a native of Asia, whence it was carried into Egypt, Barbary, Italy, Spain, and France. It is said to have been introduced into the last-named country by the Phocean colony which inhabited Marseilles 680 years B.C. The history of the olive-tree runs back to the earliest period of which any record exists. The fig-tree is the only one mentioned before it. A leaf of the olive-tree was brought by the dove to Noah as a token that the waters of the deluge were abated from off the face of the earth, and from all antiquity the olive-branch has been a symbol of peace and plenty.

Olive oil, which is obtained from the fruit by expression, is of a pale-greenish or yellowish color. When pure it is almost inodorous, and has a pleasant and somewhat sweetish taste. Its sp. gr. is 0.9192. It is soluble in nearly 1½ parts of ether, and but very slightly so in alcohol.

It appears to have been anciently used by the Hebrews as an article of food, and is so still in countries where the olive abounds, and also as a soothing and healing application to wounds, sores, and bruises, more than as an internal medicine. Most of the early medical writers dwell upon its virtues, and Dioscorides, among

them, extols it in the following terms.[1] The oil made from green olives is acceptable to the stomach on account of its astringency. It strengthens spongy gums when held in the mouth, and by inunction it represses sweating, renders the skin soft, and the limbs supple, and protects against chilliness. In its operation it is laxative, and when mixed with caustics it tempers their action. It is an antidote to poisons when taken repeatedly and as often vomited. In doses of nine ounces (?) with as much water or barley-water, it opens the bowels. In like dose with wine, in which rue has been boiled, it relieves colic, and expels worms. It may be used in clysters to overcome constipation. The oil made from wild olives is more astringent, prevents sweating, cleanses the scalp from dandriff, prevents the hair from falling out, and from growing gray when it is used daily. It also cures scabby eruptions and sores of the scalp.

Action.—In moderate quantities olive oil is very nutritious, as is proved by its general and immemorial use as an article of food, and particularly as a substitute for butter. It is scarcely less used as a condiment with salads, which it renders much more digestible. This fact has been questioned by Pereira, but it appears to have in its support the experience of all countries where olive oil is much used. In the dose of one or two ounces it acts as a very mild laxative, but it is seldom administered for this purpose to adults. In fluidrachm doses it forms a gentle laxative for infants at the breast. It is more frequently used in laxative enemata.

Uses.—Besides its occasional use as a *cathartic*, olive oil has been employed as an antidote to *poisoning* by a variety of substances, and, so far as it is effectual, may be supposed to act by enveloping the poisonous particles, and thus protecting the mucous membrane of the stomach against their action. It was formerly recommended as an antidote to the poisonous effects of *cantharides* taken internally, but its efficacy has been denied upon the ground that the active principle of these insects is soluble in oil. But since some time is required for this solution to take place, and since the object of administering the oil is to produce vomiting of the poison as well as to protect the tissues from the action of the latter, there does not seem to be a sufficient foundation for the objection referred to. The use of an ounce or two of sweet oil every morning is said to have been effectual in warding off the *poisonous effects of lead* among workers in the preparations of this metal. It has also been used in the same way as an antidote to arsenical vapors. According to Dr. Ramskill olive oil is of great advantage in various states of mal-nutrition such as are induced by *chronic gout*, *rheumatoid arthritis*, and chronic *lead poisoning*.[2]

Many writers have related examples of the efficacy of sweet oil in poisoning by *venomous serpents* and *insects*. An instance is contained in the *Philosophical Transactions*, of a peasant who was employed by the apothecaries to catch vipers, and who, whenever he was bitten by the reptiles, applied some sweet oil to the wound,

[1] Mat. Med., lib. i. cap. 28 and 29. [2] Brit. Med. Journ., Dec. 1868.

and at the same time drank a glass of it. In this manner he escaped all mischief. Pouteau praised this method as effectual; but Murray, who quotes the above example as well as many others, concludes that the efficacy of the remedy is very doubtful,[1] upon the ground, chiefly, that the viper's bite is seldom mortal. Yet it sometimes unquestionably is so. Quite recently (1849), four cases of death from this cause were published by M. Dusourd,[2] who also presents a narrative of four others in which sweet oil was administered internally, and warm oil used by friction upon the affected limbs. These cases, the symptoms of which were extremely formidable, all recovered. The same writer states that compresses wet with warm oil speedily remove the pain and swelling of wasp and hornet bites, etc. Sweet oil may also be used to destroy *insects* lodged in the auditory passage when the swelling of its walls renders other methods difficult of application. Mérat mentions the case of a gentleman who, in order to rid himself of a *tapeworm*, drank about a pound and a half of sweet oil in doses of four ounces every quarter of an hour. The tænia was expelled within twenty-four hours. Emulsions containing sweet oil are sometimes used as vehicles for various expectorant remedies, but its advantages are very questionable, and for the purpose it is inferior to almond oil.

Externally sweet oil may be used as a dressing for *excoriated surfaces*, superficial *burns*, etc., but it is less grateful and less convenient than the various ointments and cerates which are intended for this purpose, and most of which contain olive oil. Of these the best is *Lime Liniment* (LINIMENTUM CALCIS). Inunctions with warm olive oil form an excellent remedy for promoting resolution is *sprains* and *contusions*, and have been found, like other unctuous substances, an efficient means of preventing and removing *corns*. For the former purposes *Liniment of Camphor* (LINIMENTUM CAMPHORÆ) is to be preferred. The ancient method of anointing the body with oil as a protection against the *plague* is still employed with confidence by the Orientals, but the ravages of the disease do not appear to be stayed by its means. If our modern notions upon the subject are correct, the disease could only be fostered by preventing the depuration of the body by the skin. Pliny mentions olive oil as a means of repressing perspiration, and in modern times it has occasionally been used to moderate the *colliquative sweats of phthisis*. Fomentations and frictions with warm oil in *general dropsy* do not appear to have any further efficacy than may be ascribed to their rendering the skin more supple and extensible, unless, perhaps, the friction may to some extent promote absorption of the fluid. This oil is commonly used to facilitate the *introduction of sounds, catheters, bougies, specula, tents*, etc., into the natural or other cavities of the body, and some writers have recommended that in amputations the knife should be dipped into oil before the integuments are incised.

Dose.—As a *laxative*, *one or two fluidounces;* for infants, *one or two fluidrachms.*

[1] Apparat. Medicam., ii. 57. [2] Bull. de Thérap., xxxvii. 489.

MANNA.—MANNA.

Description.—Manna is "the concrete saccharine exudation, in flakes, of Fraxinus Ornus, and of F. rotundifolia," which grow in Sicily, Apulia, and Calabria, whence the manna of commerce is almost exclusively derived. It is obtained by making incisions in the bark of the tree which produces it. Straws are inserted therein, and the sap which concretes upon them is called *flake manna*. This is the finest quality, It is in light porous pieces of a pale-yellowish color, and concave upon one side. Concreted drops of this sort are called *tear manna*. Other descriptions are those which are formed by the sap trickling down the trunk of the tree, and which are gathered from its bark or from leaves heaped about its root. These are known as *fat manna*, *manna in sorts*, etc., and are more or less mixed with foreign substances.

Manna has a heavy and somewhat honeyed smell, and a mawkishly sweetish taste, which is followed by a slightly acrid sensation in the mouth. It dissolves readily in hot water and in alcohol. Its principal constituent is *mannite*, of which it contains about 60 per cent., and which has many of the characters of sugar, but, unlike sugar, it does not undergo vinous fermentation. Besides this substance, manna contains a yellow extractive matter, which is most abundant in the coarser sorts and in portions that have been long kept. It readily excites nausea, and has been regarded as the element upon which the purgative action of manna chiefly depends. The finer qualities, which contain very little of it, are used in the East for the same purposes as sugar.

History.—The word manna has been applied to several different and quite dissimilar substances. It is of Hebrew Syriac origin, and denotes "a free gift, one which imposes no obligation on those who receive it." In this sense it was applied to the food by which the Israelites were miraculously fed in the wilderness. As this substance had a sweetish taste, and fell upon the earth about early dawn, the medicinal manna, which has also such a taste and exudes from the trees which produce it during the night, obtained the same name.[1] In Latin, the name of *ros melleus*, or honey-dew, was used as an equivalent for manna, but it was specially applied to a semi-concrete substance of a honeyed taste which formed upon the leaves of various trees, and even upon stones and other lifeless objects during the night. This name is also given to a substance resembling millet seed, which is said to have fallen from the air on the confines of Silesia and Poland and in other places, and which was used as food. Its nature is quite unknown. Finally, the term manna was applied to a very different substance, a species of

[1] HOFFMANN, De Manna ejusque Præstantissimo in Medecina Usu. Oper. Omn., vi. 24. This treatise contains the whole literary history of this subject, and a complete account of the operation and uses of the medicine. Compare also FOTHERGILL's Observations on Manna Persicum, Works, iii. 257.

gum resin, thus, or frankincense, in allusion to the manner in which it exudes from its native tree.[1]

Uses.—The medicinal qualities of manna appear to have been first pointed out by the Arabian physicians, who describe it as a laxative peculiarly adapted to children and pregnant women, on account of its mildness and as being a gentle cholagogue, and at the same time a suitable expectorant in febrile affections of the lungs. It was frequently prescribed by them in conjunction with senna, rhubarb, and tamarinds. Modern experience has added absolutely nothing to these statements. In his elaborate essay, Hoffmann has enlarged upon them as a text, but has not substantially increased our knowledge. Some modern authors have attributed to manna advantages over other laxatives in cases of disease affecting the genito-urinary apparatus. It is sometimes used instead of molasses to purge off the meconium in new-born infants.

Administration.—As a large proportion of the manna taken into the stomach is digested, it must be given in large doses in order to produce a movement of the bowels; it is, therefore, apt to create flatulence and epigastric oppression besides leaving the digestive powers of the stomach feeble. It may be administered along with other purgatives, and, indeed, is generally so prescribed. One of the most frequent uses of it is with the infusion of senna, and particularly as an ingredient of the draught, composed of this infusion, Epsom salts, and fennel seed. The *dose* of manna is from *one* to *two ounces;* for *young children*, about an *eighth part* as much.

CASSIA FISTULA.—PURGING CASSIA.

History and Description.—*Cassia fistula* is a native of India, whence it was introduced into Egypt and the surrounding countries, and thence into the new world. It is extensively cultivated in the tropical regions of America for ornamental as well as commercial purposes. The rare beauty of its flowers, which are large and of a golden yellow color, and arranged in long pendent clusters, excited the admiration of the Arabian writers who furnish us with its earliest history.[2] The fruit consists of long pendulous pods, which are cylindrical, dark brown, woody, "and when agitated by the wind, strike against each other and produce a sound that may be heard a considerable distance." Internally they are divided into numerous cells by transverse plates, which are covered with a soft black pulp. This pulp, which is the officinal cassia as

[1] From *manare*, to trickle. This word is, in its turn, derived from the Chaldaic term for water; and not improbably the same fundamental idea of trickling or distilling, like dew, is associated with various products to which the word manna is applied. But O'Rorke has shown pretty conclusively that, besides the honey-dew mentioned in the text, the Israelites used and were chiefly sustained by a lichen of an amylaceous and very nutritious quality, which even to the present day is transported by the winds and falls in showers to a depth of several inches. (RANKING'S Abs., xxxiii. 285.)

[2] EBN BAITHAR, i. 401.

found in the shops, is of a blackish color and sickly odor, and has a sweet but rather mawkish taste.

Action and Uses.—According to the Arabian authorities, cassia purges away the bile, especially when it is associated with tamarinds, moderates the heat of the blood, subdues inflammations, and acts as an expectorant. It purges, they say, without pain, and is a useful ingredient in gargles for ulcerated sore throat.

In full doses, cassia acts as a mild purgative, but is very apt to create nausea, flatulence, and some griping. It is seldom given alone, but forms an excellent adjunct to other purgative medicines. Vallisneri says that it increases the cathartic virtue of manna, and that a mixture of four drachms of cassia and one and a half or two drachms of manna will purge as much as twelve drachms of cassia or thirty-two drachms of manna by themselves.[1] In the hot season, cassia may be conjoined with tamarinds and mild salines in the treatment of febrile affections. It is most frequently used as an ingredient of the *confection of senna*, which is a mild aperient and is used in habitual constipation. Lewis states[2] that during the use of cassia the urine frequently appears of a green color, and sometimes, when the quantity taken is considerable, of a dark brown or blackish color. The same observation is made by Boerhaave.[3]

Dose.—As a laxative, from sixty to one hundred and twenty grains; as a purgative, one or two ounces.

TAMARINDUS.—TAMARIND.

Description.—The tamarind (*Tamarindus Indica*) is a native of India, and its fruit has been long used there as an article of diet and in medicine. It is reckoned by the natives of so wholesome a nature, that it is a constant ingredient in their curries. The leaves and the bruised seeds are employed as astringent applications. The Arabs, on becoming acquainted with the tree, called it *tamr hindee*, that is, "the Indian date," whence, no doubt, the Latin name is derived.[4] It is produced in the West Indies also.

The officinal preparation is the pulp of the tamarind fruit preserved in sugar. It is at once sweet and acidulous. The latter quality it owes to the presence of citric, tartaric, and malic acids, and the bitartrate of potassium.

History.—Tamarinds are mentioned by the Arabian writers, who ascribe to them anti-bilious virtues, but dwell particularly on their usefulness in correcting nausea, quenching thirst, and allaying febrile excitement. They also speak of their utility in mouthwashes, and in healing aphthous sores.

Actions and Uses.—Tamarind is regarded as laxative, refrigerant, antiscorbutic, and antiseptic, and may be used, mixed with

[1] LEWIS, Materia Medica, i. 304. [2] Ibid.
[3] The Powers of Medicines, p. 209.
[4] ROYLE, Mat. Med. (Am. ed.), p. 348; AINSLIE, Mat. Med. of Hindoostan, pp. 47, 231.

water, as a cooling drink in febrile diseases. In the dose stated below, this medicine may also be employed to open the bowels, but it is seldom used alone for this purpose, but more generally as a constituent of the confection of senna. As the tartaric and citric acids of tamarind decompose most of the salts of potassium, tartar emetic should not be given in conjunction with it. It is also said to lessen the purgative action of senna.

Administration.—The dose of tamarind is from *sixty grains* to *an ounce* or *more*. By boiling an ounce of the pulp with a pint of milk, a whey is obtained which forms a pleasant and cooling drink in fevers.

OLEUM RICINI.—Castor Oil.

Description.—This oil is obtained by expression from the seeds of *Ricinus communis*, which, indeed, derives its name from the resemblance which its seeds bear to the insect called a tick (ricinus). In its native country, Asia, the plant attains the dimensions of a tree, but in temperate climates generally, and in the United States, it is an annual plant. It is very extensively cultivated in several States of the Union, and particularly in those upon the right bank of the Ohio, for the production of castor oil. It was formerly called *castus oil*, or *agnus castus*, names which it received from its supposed power of repressing venereal passion, and from them its common title is derived.

Castor oil is a very viscid white or pale yellow liquid, which, when fresh and pure, is nearly or quite inodorous, and has a mild taste at first, but which becomes afterwards somewhat nauseous and acrimonious. It is lighter than water, and does not congeal above 0° F. By exposure to the air it dries and becomes rancid. It is soluble in pure alcohol and in ether. Tuson has described as its active principle *ricinin*, and Saalmüller a peculiar fatty acid (*Ricinolsäure*).

History.—Pliny describes the castor oil plant, the mode of extracting oil from its seeds, and the etymology of its name as given above. He speaks of that which is prepared in Egypt as disgusting to mix with food, but as fit for burning.[1] Dioscorides and Galen both mention the purgative properties of the seeds, and the former states that an overdose of them occasions vomiting as well as purging, and that the oil is used to burn in lamps and as an ingredient of plasters. He does not allude to its internal use.[2] Mesue gives a full account of the seeds, which he calls royal, and dilates upon their various uses as a purgative. He also describes clysters of the oil as a remedy for colic, and inunctions of it as serviceable in piles and several external disorders, but he does not allude to its cathartic virtues. Nor do the late Arabian writers go further. They confine their descriptions to the operation and uses of the bruised leaves and

[1] Hist. Nat., xv. 7.

[2] Mat. Med., iv. 158.

seeds, which seem to have been employed chiefly in stimulating cataplasms. Indeed, there is no sufficient ground for supposing that the oil was used as a purgative until a knowledge of its properties was learned from the inhabitants of the East and West Indies. It was introduced into European practice through England, by Dr. Fraser, of Antigua, in 1759,[1] and shortly afterwards its many virtues were set forth, in a somewhat exaggerated strain, it is true, by Dr. Canvane, of Bath,[2] who extolled it especially "in colica pictonum, in most fevers, in all bilious complaints, in the thrush, in tetanus, in gonorrhœa, etc."

Action. *On Animals.*—Orfila gave a dose of castor bean varying from 15 to 180 grains to four dogs, tying the œsophagus in order to prevent vomiting, for the medicine invariably produced a tendency to it. The animals died in from six to twenty-four hours without having been purged and without displaying any striking symptoms except languor and debility. On examination, traces of gastro-intestinal inflammation were discovered.

On Man.—As the oil probably derives its purgative power from the principle which renders the seeds themselves so harsh and even poisonous, it may be well to describe their effects. M. Mialhe proved[3] that an emulsion made with the kernels of the seeds is violently emeto-cathartic in the dose of one hundred and fifty grains (from seven to ten seeds), and that even a tenth part of that quantity produces both vomiting and purging. He hence inferred that the active principle of the seeds is yielded but slightly to those varieties of the oil which are obtained by pressure alone without heat. This is more fully proved by instances such as the following: Giacomini relates[4] that when a child he experienced a violent attack of vomiting and protracted exhaustion from eating nine or ten of the seeds. Bergius[5] records the case of a man in full health who ate a single seed of ricinus, which, however, left an acrid taste in his mouth. Early the next morning he was seized with violent vomiting, which continued alternately with purging throughout the entire day. Lanzoni saw a young woman attacked with violent cholera morbus and excruciating pain in the bowels from eating three of the fresh seeds. Dr. Taylor[6] records a fatal case of poisoning from this cause. Three young women ate of the seeds, one about twenty of them, another four or five, and a third two of them. Upon the two latter persons the effects were those of a violent cathartic, but the first was seized with vomiting and purging, and looked like one in an attack of malignant cholera; the skin was cold, pale, and shrunken, there was pain in the abdomen, and the mind was in a drowsy, half conscious state. The dejections consisted of bloody serum. No reaction took place, and death occurred within twenty-four hours. On examination the gastro-

[1] Medical Observations and Inquiries, ii. 235.

[2] A Dissertation on the Oleum Palmæ Christi sive Oleum Ricini, etc., 2d ed., 1769.

[3] Bull. de Thérap., xxv. 42.

[4] Mat. Med., p. 508.

[5] Mat. Med., ii. 773.

[6] On Poisons (Am. ed.), p. 423.

intestinal mucous membrane was found to be abraded and inflamed. A soldier in Algeria is said to have died from eating only three castor oil seeds. The whole intestinal mucous membrane was found after death coated with blackish blood, the lining membrane of the stomach was somewhat reddened and softened.[1] A woman in good health took seventy or eighty grains of bruised castor seeds, and died from their operation in twenty-six hours. After death the middle division of the small intestine was found congested and very soft.[2] Two children, aged respectively six and three years, ate some of the beans, and presented the following symptoms: extreme collapse; purging with watery stools, vomiting, sweating, abdominal pain and tenderness; thirst, and a great desire to sleep. Both recovered.[3] Three other cases, which also ended favorably, are recorded by Pecholier.[4]

The effect of injecting castor oil into the veins was tried by Hale upon his own person.[5] After losing eight ounces of blood from the arm, he had half an ounce of the oil injected into a vein. At the expiration of twenty-five minutes he perceived the taste of the oil in his mouth; malaise succeeded, with nausea, eructation, rigidity of the facial muscles and of the tongue, loss of speech, anxiety and faintness, with general dulness and depression. At the end of three hours there was an unsuccessful motion to evacuate the bowels. Feverishness followed, and indisposition of several weeks' duration.

Canvane states that by only rubbing the navel and hypochondria with this oil in children whom he could not get to take any medicine inwardly, he often procured one or two loose stools. The odor alone is said sometimes to produce a purgative effect upon weak and delicate children. By repeated friction with the oil the skin is reddened and ultimately vesicated. In the dose of one or two ounces it occasions an uneasy feeling in the stomach, and not unfrequently vomiting. But when taken in divided doses, as half an ounce at intervals of four hours, it seldom occasions vomiting, but more generally nausea, and the bowels are apt to be moved before the second dose. The second or even the third may sometimes be required for this purpose. It seldom produces much griping, unless the bowels are in a morbidly sensitive condition. The frequency of the pulse is lowered, meanwhile, a sense of peculiar discomfort is felt in the abdomen, there is also an inclination to sleep, with general debility. The evacuations which it produces are, after the first one, generally liquid, but they contain more or less of the oil in the form of globules, and unchanged, or, as Dr. Bird has pointed out, converted into caseous flakes or a soap-like scum floating on the more fluid parts of dejection. More generally it is found mixed up with the fæces as a kind of emulsion, and in some few instances it has been discharged under the form of solid tallow-like masses.

[1] Times and Gaz., May, 1861, p. 555. [2] Archives Gén., 6ème sér., xiii. 284.
[3] Times and Gaz., May, 1870, p. 581. [4] Bull. de Thérap., lxxviii. 37.
[5] MITSCHERLICH, Lehrbuch, i. 150; WIBMER, Wirkung, etc., iv. 413.

Long-continued use of the oil disorders the digestion and occasions habitual nausea, with a furred tongue, etc., particularly if the oil is acrid from having been kept, or from imperfect preparation. Cullen states that when taken habitually as an aperient the dose may be gradually diminished. This statement is confirmed by Burne,[1] who says that it acts quickly, does not produce a subsequent costiveness, and the longer it is given the less is the dose of it required. If taken daily, the quantity may gradually be reduced to half a teaspoonful (Dr. Thompson says to a few drops), and yet the full effect be maintained.

Castor oil has been known, instead of acting as a purgative, to exude from the skin. Such a case is related by Dr. T. O. Ward, of an hydræmic female, who also presented the remarkable phenomenon of pulsation of the veins of the forearms.[2]

Uses.—Castor oil is universally employed in this country and in England as a domestic remedy, especially in children's complaints. Its use by physicians as a purgative is hardly less general in all cases which are thought to require a mere evacuation of the bowels, when they contain fæces, as in *constipation*, or irritating ingesta as in *diarrhœa* produced by unwholesome or indigestible food, or when, under the influence of local inflammation of a subacute grade, they secrete an undue quantity of mucus, or discharge blood. To all of these cases castor oil is peculiarly adapted, because, while it impresses the general system very slightly, it has a sanative influence upon the bowels themselves. It should be given as early as possible after the onset of these affections. Even in *dysentery*, when thus employed, it is generally sufficient for the cure. It is an equally effectual remedy for *infantile diarrhœa*, as nearly all the authorities upon the diseases of early life testify. A recent writer describes the form of *bowel complaint* in which it is most beneficial[3] as an aphthous diarrhœa which occurs during the first year of life, especially among children who are improperly fed, and commences with sickness, frequent and griping evacuations varying in color from greenish-yellow to dark grass green, these becoming more liquid and more or less mixed with slimy or gelatinous mucus streaked with blood, or even at last with a predominance of blood, each evacuation accompanied with pain and tenesmus, the mouth dry and aphthous, the anus inflamed, the belly tumid and painful, the child becoming more and more feverish, emaciated, and somnolent. In such cases the castor oil emulsion made with the yelk of egg, combined or not with very gentle opiates, will be found sufficient to effect a cure. ℞.—Ol. ricini f℥j–f℥iss; vitell. ovi semis., aqu. anisi, aqu. fœniculi, āā f℥j.—Ft. emuls. S.—A teaspoonful twice a day. The diarrhœa of older children, and even of adults, may be treated in the same manner, but with a proportionally larger dose.

In the disease known as *Devonshire colic*, Madrid, West Indian,

[1] On Habitual Constipation, p. 218. [2] Lond. Med. Gaz., x. 377.
[3] Dr. Thompson, Month. Journ. of Med. Sci., vi. 88.

Poitou colic (colica pictonum), an affection produced by acid drinks containing lead, this medicine was early recommended by Canvane, who seems to have derived a knowledge of its use from West Indian practitioners. He gave it by enema, and also by the mouth, in tablespoonful doses, every hour or half hour until an evacuation took place; but if the stomach refused to retain it, he first administered an emetic of ipecacuanha. Spanish physicians of the present day have recourse to castor oil as a purgative in this complaint. Several writers have recommended castor oil in *lead colic*, and certainly in mild cases it is sufficiently active when given after a full dose of calomel, associated with opium, to put an end to the attack. Yet it is perhaps less efficient than the saline and antimonial purgatives, which, in conjunction with opiates, constitute essentially the treatment of *La Charité*, so famous for its success in France.

Worms.—Odier, of Geneva, first used this oil for the purpose of expelling intestinal worms, and particularly the *tænia*, both armed and unarmed.[1] Brera says that it both kills the worms and purges them from the patient; and he mentions two cases of armed tænia expelled by three ounces of this oil, taken by a patient during three successive days, and by another taken twice a day for a week. Bremser[2] denies that it possesses any specific vermifuge properties.

Among the numerous forms of disease for which castor oil is an appropriate medicine, acute inflammation of the lining membrane of the *bronchia* and air-passages may be mentioned. In this affection the medicine appears, more than any other of its class, to mitigate the inflammation and to promote the resolution of the disease by expectoration. The febrile symptoms after *parturition*, known as milk fever, and the forming stage of *mammary abscess*, are very generally controlled by a dose of castor oil; indeed, it is in a peculiar manner suited to be employed as a laxative in the puerperal state. Its gentle and certain action also renders it appropriate in the somewhat analogous circumstances of persons laboring under *irritative fever*, or simply from constipation after the accidents of surgical operations. It is said to have a soothing influence in *nephritic inflammation* and *nephralgia* arising from the presence of calculi in the kidneys.

Externally.—The *galactagogue* and *emmenagogue* qualities of the castor oil plant have attracted considerable attention since Dr. McWilliam first gave the following account of its use in Africa: "In childbirth, when the milk is delayed, a decoction is made by boiling a handful of the plant in six or eight pints of water, with which the breasts are bathed for fifteen or eighteen minutes; part of the boiled leaves are also spread over the breasts. The process is said generally to induce a flow of milk in a few hours."[3] The same physician has shown that the Spaniards of Peru were acquainted with the galactagogue qualities of this plant in the early part of the eighteenth century; and it also appears that the negro

[1] BRERA (Am. ed.), p. 235.
[2] Ueber lebende Würmer im lebenden Menschen, p. 163. [3] Lancet, Sept. 1850.

women of Jamaica poultice their breasts with the leaves, to cause a copious flow of milk.[1] Dr. Tyler Smith published several cases in which a decoction of the leaves was used after the manner described above, and with a prompt and very marked increase of the secretion of milk, with swelling and hardness of the mammæ, and pains in the back.[2] Dr. Routh pronounced an equally favorable judgment upon the value of the medicine, which he was the first to administer internally in the form of a decoction, and afterwards of a tincture and an extract.[3] Subsequently, Dr. Gilfillan produced equally striking effects by teaspoonful doses of a fluid extract of the leaves.[4] Dr. Cormack has objected to attributing galactagogue virtues to the castor oil plant, alleging that hot fomentations and sinapisms will have the same effect, of which he presents several striking illustrations;[5] but it is to be remarked that the irritation produced by the castor oil leaves is very trifling, that their application has proved successful in exciting a secretion of milk when warm fomentations, friction, and stimulating liniments remained inoperative, and, above all, that the internal administration of the extract has produced the same effects as the local application of the leaves. Nor is the familiar fact to be overlooked that a dose of castor oil is habitually given to lying-in women as soon as the first signs of the milk fever manifest themselves. The universal preference for this over every other evacuant is very probably founded upon habitual experience of its special usefulness.

Dr. Nott treated with success, in the Charity Hospital of New Orleans, two patients laboring under *amenorrhœa*, by rubbing the breasts three times a day with a decoction of the leaves of Ricinus communis, and afterwards applying to the same parts the leaves which had been used to prepare the decoction.[6] The oil forms one of the best ingredients of ointments and liniments used in the treatment of *alopecia*. For this purpose Hardy recommends the following pomatum: "Suet, 60 grammes; castor-oil, 25 do.; gallic acid, 2 do.; with a few drops of essence of vanilla."

Administration.—Various methods have been contrived to diminish the repugnance of the palate to this medicine. It is frequently given in emulsion with the yelk of egg, or with gum Arabic, but these mixtures lessen its activity as a purgative. It is said to be rendered quite palatable by being mixed with an equal quantity of pure glycerine previously rubbed up with a few drops of oil of cinnamon. It is also administered floating upon mint-water, milk, coffee, etc.; but not only do these vehicles fail to disguise its taste effectually, they are also apt to become objects of aversion in consequence. If the mouth and fauces are washed with brandy or strong wine, and the oil is taken from a glass the interior of which has been moistened in like manner, it will not adhere sufficiently to excite disgust. But of all methods the best is to

[1] Lond. Journ. of Med., ii. 1085. [2] Ibid., p. 951.
[3] Times and Gaz., June, 1859, p. 574; Brit. Med. Journ., Dec. 1859.
[4] Amer. Med. Times, iv. 23, 218. [5] RANKING's Abstract (Am. ed.), xvii. 276.
[6] Phil. Med. Exam., April, 1855, p. 246.

envelop the oil with foam of beer, ale, or porter in a wineglass. The oil then forms a large globule, which may be swallowed without even its presence being detected.

SENNA.—Senna.

Description.—This medicine consists of the leaflets of *Cassia acutifolia*, *C. obovata*, and of *C. elongata*. These plants are chiefly natives of Egypt and Arabia, but they have been transplanted to the East and West Indies, and are successfully cultivated there. The senna of commerce is principally derived from the port of Alexandria in Egypt. The plants which produce it are shrubs, or small trees, according to the region where they flourish. The leaflets are narrow, pinnate, and lanceolate, and the legumes oblong, membranous, and about half an inch in length.

Senna has a nauseous and bitter taste, and a somewhat fragrant color, but an extremely sickening smell, when infused. It is this property, more than any other, which excites so general a repugnance to taking it. Besides other principles it contains a volatile oil, upon which its odor depends, and *cathartin*, from which it derives its characteristic taste and its purgative properties.

The principal officinal preparations of senna are the following:—

Confectio Sennæ.—*Confection of Senna; Lenitive Electuary.*

This confection contains, beside senna, coriander-seed, liquorice-root, figs, pulp of prunes, tamarinds, and purging cassia, besides sugar and water. Its dose is one hundred and twenty grains.

Extractum Sennæ Fluidum.—*Fluid Extract of Senna.*

From sixteen troyounces of senna in moderately fine powder a tincture is procured with diluted alcohol, which, after evaporation and the addition of eight troyounces of sugar, should measure a pint. Dose, half a fluidounce.

Infusum Sennæ.—*Infusion of Senna.*

The infusion of senna is prepared with a troyounce of senna, sixty grains of bruised coriander-seed, and a pint of boiling water, allowed to macerate for an hour in a covered vessel, and strained. The dose is four fluidounces.

Tincture Rhei et Sennæ.—*Tincture of Rhubarb and Senna; Warner's Gout Cordial.*

Its virtues are due to the rhubarb rather than to the senna which it contains. (Vide Rheum.)

History.—Arabian writers furnish the earliest notice of this medicine. One of them, Isaac Ben Honain, recommends the *fruit* as a purge in melancholy, and also as an application to chapped hands. He adds that it is sometimes useful in muscular cramps, alopecia, calvities, obstinate headache, phthiriasis, scabies, pustular eruptions, pruritus, the lousy disease, and epilepsy. Another writer

describes it as apt to create uneasiness in the bowels, unless when associated with violets or some other corrective. He recommends an infusion or decoction of senna.[1] Haly Abbas refers to similar combinations for the same purpose, and particularly to a decoction of senna with prunes and spikenard.[2] Ever since its first introduction into the materia medica it has been very extensively used as a purgative, a fact which better than any reasoning about its powers demonstrates its value.

Action. *On Animals.*—A decoction of senna injected into a dog's veins produced agitated movements of the abdomen and bilious vomiting.[3] It readily purges swine, dogs, and cats, and in large doses horses also.[4]

On Man.—The odor of senna-leaves, or that of its infusion, is sufficient to cause an evacuation of the bowels in certain susceptible persons. Bergius states that it renders the milk of a nursing female purgative to her infant. This fact proves the absorption of its active principle. It is very apt to create flatulence and colic, unless associated with some aromatic substance. Schwilgué describes it as exciting a sense of warmth in the abdomen, and some acceleration of the pulse; he states also, that it produces yellow stools, and that its action is not followed by constipation. It is, hence, probable that the action of senna is exerted chiefly upon the small intestine. There is, perhaps, no instance on record of its having produced hypercatharsis. Its operation is said to be much increased by an association with bitter medicines, and such a combination becomes, therefore, a valuable one in constipation from debility.

Courten, and also Regnaudot, injected an infusion of senna into the veins, which occasioned both vomiting and purging.[5]

Uses.—Senna is employed in cases which require a prompt and copious evacuation of the bowels. Hence it is a favorite remedy in constipation and indispositions depending upon this state, both as an occasional and as an habitual purgative. Its peculiarity of not leaving the bowels confined renders it a valuable medicine in such cases.

Administration.—Senna is seldom given alone, but generally along with some corrective of its griping qualities, or else associated with other purgative medicines. The simple *infusion* of senna, the infusion of senna with tamarinds, and the infusion of senna with Epsom salts, manna, and fennel seed known as the *black draught*, are the most ordinary and efficient modes of administering this medicine. Care should be taken not to let the leaves macerate too long, nor to use any compression of them when the liquid of the infusion is removed, lest their acrid principle should be taken up and produce griping. The dose of either of these preparations

[1] Ebn Baithar, Heil- und Nahrungslehre, ii. 58.
[2] Adams, Comment. on Paul. Æginet, iii. 432.
[3] Wibmer, Wirkung, etc., ii. 67.
[4] Mitscherlich, Lehrbuch, etc., ii. 633.
[5] Wibmer, loc. sup. cit.

is from *two* to *four fluidounces*. The *confection* of senna forms an eligible basis for various purgative compounds, and is itself a mild and efficient laxative in the dose of one hundred and twenty grains. The *fluid-extract* is the most concentrated and active of all the preparations of this medicine; it forms an excellent purgative for children in the dose of a *fluidrachm*, and of *half a fluidounce* for an adult. The *tinctures* into which senna enters are chiefly used as cordial purgatives in persons of a gouty habit; this is particularly the case with the tincture of *rhubarb* and *senna*, known as *Warner's gout cordial*, which is prescribed in doses of *half a fluidounce*, and from that to *two fluidounces*. The compound tincture of senna (*elixir salutis*) and the tincture of senna and jalap, which are no longer officinal, may be given in doses of from *two fluidrachms* to a *fluidounce*. It should be borne in mind, that water dissolves a much larger proportion than alcohol of the purgative elements of senna, and hence that all preparations of senna made with strong alcohol are feeble purgatives.

CASSIA MARILANDICA.—American Senna.

Description, etc.—This beautiful and showy plant, says Griffith, is found in most parts of the United States, in moist situations, and along watercourses. It is about three feet high, with many stems, arising from a woody, perennial root. The leaves are alternate, and are composed of eight or nine pairs of ovate and lanceolate leaflets, which are the officinal portion of the plant. The legume is long, narrow, arcuated, and contains many seeds.

The Shakers cultivate it to some extent. It is generally held to be inferior to Alexandria senna, and is said to require a dose one-third larger to produce an ordinary cathartic effect. But "those who have given it the fairest trial consider it equal to the generality of the imported article." Dr. Eberle frequently employed it instead of the latter, and always found it a certain and safe purgative.[1]

RHEUM.—Rhubarb.

Description.—The plant which produces the best qualities of rhubarb is still unknown. The United States Pharmacopœia refers the drug to "Rheum palmatum, and other species of Rheum from China, Chinese Tartary, and Thibet." The root is the officinal part. All the plants of the genus Rheum "are perennial and herbaceous, with large, branching roots, which send forth vigorous stems from four to eight feet or more in height, surrounded at their base with numerous very large petiolate leaves, and terminating in lengthened

[1] Griffith, Med. Bot., p. 261; Eberle, Mat. Med., p. 147.

branching panicles composed of small and very numerous flowers, resembling those of the rumex or dock."[1] The roots are thick, ligneous, and of a yellowish color.

The greater part of the rhubarb of commerce comes from the North of China through Tartary and Russia. It is generally known as Turkey rhubarb, because it anciently, and indeed until recently, entered into commerce through that country alone. Another portion derived from the same original source is imported from Canton, and is called India rhubarb. It is also cultivated for medicinal purposes in England and France.

As found in commerce, the several varieties of rhubarb differ somewhat among themselves in physical characters, but the following are the most essential: It consists of sections of the root without the cortex, which are more or less cylindrical in shape, and either of a bright or brownish-yellow color. The fracture is uneven, and presents a mixture of brownish-red and yellowish veins and spots. The odor is peculiar and somewhat aromatic, particularly in the Russian variety. Its taste is slightly bitter and astringent, and, owing to the presence of crystals of oxalate of lime, in the proportion of more than thirty grains to one hundred of the root, it feels gritty under the teeth. When chewed, it colors the saliva yellow. The English and French rhubarbs are rather reddish than yellow, are of lower specific gravity, more mucilaginous and astringent than aromatic, and scarcely feel gritty when chewed.

Rhubarb yields its medicinal properties to water and alcohol. It is uncertain upon what elements these properties depend; but probably not upon any single one, but rather upon the resinous, astringent, and bitter principles combined. The active principles of rhubarb, according to Schroff, are *chrysophanic acid*, *rhein* and *rhabarbarin*. All of these substances are purgative, but the second is the most so.

The following preparations of rhubarb are officinal:—

EXTRACTUM RHEI.—*Extract of Rhubarb.*

This extract is prepared by percolation from rhubarb in coarse powder with alcohol, and by evaporating the product to a proper consistence. Its dose is from ten to fifteen grains.

EXTRACTUM RHEI FLUIDUM.—*Fluid Extract of Rhubarb.*

Sixteen troyounces of powdered rhubarb are treated with a mixture of glycerin, alcohol, and water, to the production of a pint of fluid extract. The dose, as a purgative, is half a fluidrachm.

INFUSUM RHEI.—*Infusion of Rhubarb.*

One hundred and twenty grains of bruised rhubarb are infused in half a pint of boiling water, digested for two hours in a covered vessel, and strained. Dose, one or two fluidounces repeated every three or four hours until it operates.

[1] U. S. Dispensatory.

PILULÆ RHEI.—*Pills of Rhubarb.*

Seventy-two grains of powdered rhubarb and twenty-four grains of soap are beaten into a mass, and divided into twenty-four pills. Each pill contains three grains of rhubarb and one of soap. Dose, three or four pills, as a laxative.

PILULÆ RHEI COMPOSITÆ.—*Compound Pills of Rhubarb.*

Forty-eight grains of rhubarb, thirty-six grains of socotrine aloes, twenty-four grains of myrrh, and three minims of oil of peppermint are beaten into a mass and divided into twenty-four pills. Each pill contains about five grains of the mass. Dose, from two to four pills.

SYRUPUS RHEI.—*Syrup of Rhubarb.*

This preparation is made by forming a syrup with fluid extract of rhubarb, three fluidounces, and syrup twenty-nine fluidounces. It is used as a cathartic for infants in the dose of one or two fluidrachms.

SYRUPUS RHEI AROMATICUS.—*Aromatic Syrup of Rhubarb.*

Powdered rhubarb, two troyounces and a half; powdered cloves and cinnamon, of each half a troyounce; and powdered nutmeg, one hundred and twenty grains, are treated with diluted alcohol by percolation, until a pint of tincture is procured. This is then mixed with six pints of syrup. The dose for an infant is a fluidrachm.

TINCTURA RHEI.—*Tincture of Rhubarb.*

This is a simple tincture made with three troyounces of powdered rhubarb, half a troyounce of powdered cardamom, and sufficient alcohol to obtain two pints of tincture. It is seldom used alone, but generally to qualify the action of saline purgatives, or in gouty or other feeble states of the system requiring a stimulant as well as a laxative operation. Dose, half a fluidounce.

TINCTURE RHEI ET SENNÆ.—*Tincture of Rhubarb and Senna; Warner's Gout Cordial.*

In the preparation of this tincture are used, besides rhubarb and senna, coriander and fennel-seed, saffron, liquorice, and raisins. It is adapted to relieve constipation in persons debilitated by gout, and in whom the digestive organs are impaired. Its dose is from half a fluidounce to two fluidounces.

VINUM RHEI.—*Wine of Rhubarb.*

Two troyounces of rhubarb and sixty grains of canella are exhausted by means of sherry wine and diluted alcohol. It has the same general properties as the tincture of rhubarb, but is less stimulating. Dose, from one to four fluidrachms, repeated if necessary.

History.—The names Rhabarbarum and Rheum are derived from that of the river Rhâ (Volga), which empties into the northern extremity of the Caspian Sea, because from this direction rhubarb was anciently, as at present, brought to the countries bordering on

the Levant. The term Rha-pontic, applied to the species of rhubarb described by Dioscorides, refers to its source in ancient Thrace, near the Pontic or Euxine Sea. The name Rhabarbarum, whence Rhubarb is immediately derived, is applied by several ancient writers to the drug brought from the barbarous regions of the north, for Mesue[1] describes three sorts of it (rhâ), viz.: "Indianum, *Barbarum*, et Turcicum."

Rhapontic rhubarb possessed no purgative properties, but was used as a stimulant astringent.[2] The first definite account of purgative rhubarb is contained in the works of the Arabian physicians. Thus, Ebn Dschamia mentions four varieties of the drug. The first, which he calls Syrian, was probably the non-purgative variety; the others were the Chinese, the Tartar, and the Turkish or Persian. The Arabians describe the last three as purgative, and the Turkish as pre-eminently so. Ebn Baithar,[3] speaks expressly of the ignorance of the earlier physicians respecting the cathartic properties of rhubarb, and ascribes the publication of them to his countrymen. They have proved, he says, that it acts as a deobstruent by removing inspissated mucus and all concocted juices, and strengthens the liver, the stomach, and the rest of the internal organs. It is useful, he continues, in mental disorders, and in all dropsies except those which depend upon atony of the intestines. In chronic diarrhœa depending upon abdominal infarctions it is a curative when mixed with wine and Indian spikenard, and in dysentery also when combined with medicines which abate its purgative operation and promote its astringent and healing action. It cures the stone in its forming stage and favors its disintegration; is useful in uterine hemorrhage, in hemicrania depending upon disordered digestion, and as an external application with vinegar to various dry eruptions of the skin. These form but a small portion of the cases in which Arabian authors recommend rhubarb, but they are also the most important and intelligible. Matthiolus states that powdered rhubarb is astringent, and becomes more so when it is roasted.

Action. *On Animals.*—In large doses it purges horses; in doses of one or two drachms it sometimes acts on dogs as a cathartic, but not uniformly. Tiedemann and Gmelin[4] found that after the exhibition of rhubarb the serum of the blood of the mesenteric, splenic, and portal veins was tinged yellow, but the chyle was unaffected; the urine was of a dark yellow color, and on the addition of caustic potash turned brown.

On Man.—The primary effect of rhubarb is purgative; its secondary effect astringent. According to Bergius, a dose of two scruples procures from three to five stools, but they are not as liquid as those produced by saline or by drastic purges. A much smaller quantity, taken daily in mass and allowed to dissolve in the mouth,

[1] MATTHIOLUS, Comment., iii. 2, p. 247. Comp. PANCIROLLIUS, Nova Reperta, ii. 121.
[2] DIOSCORIDES, iii. 2.
[3] Heil- u. Nahrungsmittel, i. 484.
[4] MITSCHERLICH, Lehrbuch, i. 333.

will for a long time continue to act as a mild laxative. This medicine does not weaken the digestion, but rather tends to strengthen it, and hence Richter assigned it a place between the bitter tonic and the resinous cathartics. Chapman asserts that, combined with opium its operation is not at all restrained, but the statement seems to need confirmation. Rhubarb, before it manifests its action upon the bowels, tinges the urine of a reddish yellow color, like that it acquires in jaundice or in febrile diseases. The milk of nursing women also assumes a yellow tinge and a bitter taste, and the linen is sometimes stained of the same color by the perspiration. The yellowness it imparts to the fæces no doubt led to the notion that it promoted the biliary secretion. Nearly all recent writers deny this operation, but Mitscherlich advocates its reality; he does not, however, regard the action as peculiar to rhubarb, but only as one which it possesses in common with most other purgatives. Sachs goes so far as to assert that the purgative action of the medicine is subordinate to its cholagogue properties. This notion is clearly hypothetical, for in cases of complete obstruction of the biliary ducts the stools produced by rhubarb are none the less yellow. Rhubarb is said by Alibert to purge when it is incorporated with saliva and rubbed upon the abdomen.

Uses. *As a Purgative.*—Rhubarb is not a suitable evacuant in *symptomatic* febrile affections, except in those of the intestinal canal. But in nervous and putrid *fevers* it has been thought preferable to saline and other purgatives.[1] It is also recommended in non-febrile *disorders of digestion* following acute diseases and accompanied with a bitter taste in the mouth, slight pain in the epigastrium, and constipation; in those also which result from over-eating, sexual excesses, and loss of sleep; and in such as occur in chlorotic and nervous females and in hypochondriacs.[2] Dr. S. Jackson, of Northumberland, spoke of it as a remedy of surprising efficacy in *piles* when laxatives are needed.[3] He directed a piece about ten grains in weight to be chewed or rather slowly dissolved in the mouth every night, or less frequently according to the degree of constipation present. He estimated its power when thus employed as equal to that of five times the quantity in powder. He also recommended it as a convenient and certain means of combating the costiveness incident to pregnancy and the hæmorrhoidal swellings which are incident to this state. We can add our testimony in favor of this method, which has a great advantage over the use of occasional laxatives.

In the forms of *diarrhœa* incident to debility of the bowels, either when this condition depends upon general causes alone or is the immediate effect of irritating ingesta, rhubarb is superior to almost every other medicine. Experience has also shown it to be a useful purgative in the bowel complaints of summer, and particularly among children. In these disorders it is that the aromatic syrup of

[1] MURRAY, App. Med., iii. 391. [2] TROUSSEAU and PIDOUX, Thérap., i. 730.
[3] Am. Journ. of Med. Sci., vi. 315.

ıubarb is so generally and beneficially employed. The combina-
ɔn of rhubarb with tonic infusions is also serviceable in the same
fection; if the stools are pale and mucous, it may be associated
ith mercurials, and if there is a predominance of acid, magnesia
ay be substituted for the latter, or given in addition. Burnt rhu-
ırb has already been mentioned as an old remedy for diarrhœa.
has been recommended anew by Mr. Hoblyn.[1] He caused rhu-
ırb to be burned in an iron crucible, stirring it until it was black-
ed; it was then smothered in a covered jar. For more than
'enty years he says that he used it successfully in incidental diar-
œas, giving it in doses of from five to ten grains. After one or
'o doses the pains quickly subsided, and the bowels returned to
eir natural state. He found it equally useful in the diarrhœa of
ıthisis.

According to Murray, opinions are unanimous in favor of rhu-
rb in *dysentery*, but they differ in regard to the proper occasion
r its employment. The best authorities do not, on the whole,
nfirm this statement. Degner is perhaps the only one who is an
ception. He recommended the medicine in all stages of the dis-
se as abundantly able to effect the cure alone. Pringle, after the
ample of Barbette and of Degner made use of the remedy in
winter and vernal fluxes," but he does not seem to have depended
ıch upon its efficacy.[2] Murray, himself, thought it most suitable
ıen the disease tends to become chronic, and debilitating evacu-
ts are no longer proper. It then, he says, acts as an astringent
d tonic.[3] Richter, and also Cullen,[4] condemned it in acute dysen-
ry; and Zimmerman[5] agrees with Monro and Brocklesby, whom
quotes, that in general the medicine is appropriate only after
e acute stage of the disease. In certain epidemics, when the sto-
ıch rejected manna, tamarinds, and neutral salts, he found the
ıcture of rhubarb sometimes advantageous. On the whole, it is
ident that rhubarb is of very subordinate value in the treatment
dysentery.

Externally.—Powdered rhubarb has been recommended by Home
an application to *old* and *indolent ulcers* for the purpose of pro-
ɔting their granulation. Eberle says that he derived much benefit
ɔm sprinkling indolent chancres with a powder composed of about
cty grains of very finely-powdered rhubarb with twenty grains
calomel and ten of powdered opium. The share of the rhubarb
the benefit must, however, have been trifling.

Administration.—Rhubarb is administered in a great variety
forms, including the powder, infusion, tincture, syrup, and in
mbination with nearly all medicines of the cathartic class. In
wder, the average dose, as a purgative, is twenty grains; as a
ntle aperient and tonic, five grains. When associated with
lomel, its action is prompt and efficient; this combination is

[1] Lancet, Feb. 1841, p. 790.
[2] Diseases of the Army, p. 236.
[3] Apparat. Med., iii. 396.
[4] Mat. Med., ii. 530.
[5] Traité de la Dysentérie, chap. iv.

much used at the commencement of autumnal fevers. With magnesia it is employed in dyspepsia with acid eructations and torpor of the bowels. As a mild laxative for habitual or occasional use, the simple rhubarb pill (*Pil. rhei*) which contains soap, is an eligible form. The *infusion* is generally employed as a vehicle for other purgatives or for vegetable tonics. The *tinctures* of rhubarb are almost exclusively used in cases which require a stimulant cathartic; their dose is from half a fluidounce to a fluidounce. The simple and the aromatic *syrups* of rhubarb, the latter especially, are very useful laxatives in the bowel complaints of children, particularly during the summer season. The *fluid extract* is an efficient preparation of rhubarb in the dose of half a fluidrachm. The various combinations of this medicine, which are only of secondary importance, need not here be mentioned.

JUGLANS.—BUTTERNUT.

Description.—*Juglans cinerea* is a native American forest tree. Its immature fruit is familiarly used in the preparation of pickles, and when ripe its kernel is eaten by those who do not object to its strong and oily taste. The inner bark of the root is its medicinal portion. Applied to the skin it is capable of producing vesication. A decoction of it is sometimes used in domestic practice, but the extract (*Extractum juglandis*) is generally preferred. In doses of from fifteen to thirty grains the latter is an active cathartic, and operates without occasioning heat or irritation.

It is said to be peculiarly applicable as an aperient in habitual costiveness, since it does not tend as much as many other purgatives to leave the bowels in a confined state.

COLOCYNTHIS.—COLOCYNTH.

Description.—Colocynth is the fruit, deprived of its rind, of *Citrullus Colocynthis*, a plant which grows wild in Asia Minor, Syria, Nubia, Egypt, the Greek Islands, Japan, and at the Cape of Good Hope. It is cultivated in the South of Europe, and especially in Spain, and is about the size of an orange-tree. The fruit is globose, and measures from two to four inches in diameter; it has a yellow, smooth, hard, and thin rind, which is generally removed before the fruit enters into commerce. The pulp is nearly white, light, spongy, porous, tough, elastic, and contains numerous seeds around its circumference, arranged in double rows. It is intensely bitter and nauseous. These qualities are supposed to be derived from a proximate principle called *colocynthin*, a reddish-brown or light-yellow, brittle, and pulverizable substance, of an extremely bitter taste, and soluble in water and in alcohol.

The principal officinal preparations of colocynth are

EXTRACTUM COLOCYNTHIDIS.—*Extract of Colocynth.*

This extract is procured from the pulp of colocynth in powder, by maceration in diluted alcohol, by percolation, and by evaporation. Forty-eight ounces of the pulp yield about seven troyounces of extract. Use, to form the compound extract.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM.—*Compound Extract of Colocynth.*

This preparation contains extract of colocynth, aloes, scammony, cardamom, and soap, united by mixture. It is an efficient cathartic in the dose of ten grains.

History.—Hippocrates directed a tampon covered with colocynth to be introduced into the os uteri for the purpose of bringing on labor artificially in cases in which abortion takes place regularly at the same period of pregnancy.[1] Dioscorides speaks of the intense bitterness of the fruit, and of its cathartic properties, which he describes as so powerful as sometimes to produce bloody stools, besides thoroughly cleansing the bowels. He alludes to the use of it described by Hippocrates, and recommends a suppository of it as a purgative; he also states that its fresh juice is useful in sciatica when rubbed upon the painful part.[2] Galen notices the fact that, in spite of its bitterness, it has none of the properties of bitter medicines, but is an active cathartic. Rhazes and other Arabian writers state[3] that it purges mucus and bile, is useful in paralysis, spasmodic diseases, headaches and other head affections, including insanity. It was much recommended in gout and rheumatism. In cold weather it is said to be very apt to occasion borborygmi and colics, and during the heats of summer to bring on dysentery. One writer speaks of it as an ingredient in a hair-dye, and another as a remedy for alopecia and scaly eruptions of the scalp. It was held in great esteem as a cure for scorpions' bites, and a decoction of it in oil was used by dropping into the ear to relieve tinnitus. Its acrimony was said to be corrected by an admixture with gum Arabic or tragacanth; and the addition of aromatics, salines, and aloes was advised to render its purgative action more gentle. Its poisonous effects are described by Matthiolus as identical with those of scammony and other drastics, viz., bloody stools, with violent pain and inflammation of the bowels.

Action. *On Animals.*—Unless in large doses, it acts but feebly upon horses, sheep, and swine.[4] According to Orfila's experiments on dogs,[5] this substance purges, inflames the lower bowels, and at the same time depresses the nervous system. In doses of about seven and four grains, administered to two rabbits, Schroff found that *colocynthin* proved fatal in the course of four hours, after producing copious fluid dejections. The gastro-intestinal mucous membrane was found to be highly inflamed.[6]

[1] De Superfœtatione, xii.
[2] Lib. iv. chap. clxxi.
[3] EBN BAITHAR, ed. Sontheimer, ii. 284.
[4] WIBMER, Wirkung, ii. 230.
[5] Toxicologie, ii. 108.
[6] REIL, Mat. Med., etc., p. 129.

On Man.—At the Cape of Good Hope colocynth is said to be eaten by the inhabitants as a pickle, without injury. In the North of Africa the seeds are reported to be exclusively used as an article of food, and to be mild, oleaginous, and nutritious. But the seeds of commercial colocynth have been found to produce purgative effects on dogs. In small or moderate doses colocynth appears to quicken the peristaltic action of the bowels, and to augment their secretion and that of the liver. The stools are generally mucous and watery, and are accompanied with colicky pains. If any faith can be reposed in the experiments of Hechenberger, a single drop of the tincture of colocynth (*Pharm. Austr.*) taken twice a day for several weeks, produced looseness of the bowels at the expiration of this period! The same quantity, taken every two hours by susceptible persons, occasioned diarrhœa in the course of the day or the next morning, with griping pain in the abdomen. A pregnant female, who took a teaspoonful of the tincture, was seized with a dysenteric flux, a burning pain in the loins, swelling of the vulva, and a sense of bearing down and heat in the vagina.[1]

In very large doses colocynth acts as a violent irritant poison. Murray relates several cases in which the effects produced were excruciating pain in the abdomen, vomiting, mucous, serous, and bloody stools, and muscular spasms.[2] Tulpius, Plater, Fordyce, and others, report fatal cases of its operation.[3] In one recorded by Caron and d'Annecy[4] the medicine produced frequent stools, with tormina, and, some hours afterwards, intolerable heat in the abdomen, dryness of the throat, and intense thirst. Somewhat later the signs of peritonitis supervened, a small and frequent pulse, red tongue, tumid and tender abdomen, severe pain near the umbilicus, and suppression of the stools. On the third day these symptoms were succeeded by the collapse of approaching dissolution, which took place on the same night. The peritoneal cavity was found to contain much serum and fibrin, and the intestinal mucous membrane was ulcerated. Dr. Christison quotes the case of a female who died, after incessant vomiting and purging, within twenty-four hours after having swallowed, by mistake, a teaspoonful and a half of colocynth powder.[5] Mr. Tidy has reported the case of a healthy woman who died after taking a dose of powdered colocynth estimated at from one to three drachms. The only symptoms were incessant vomiting and purging. After death the gastric-mucous membrane was pale.[6] According to Richter, all the symptoms of a violent irritant poison may be produced by rubbing the abdomen with a solution of colocynth. Salgues, of Dijon, removed obstinate constipation by applying powdered colocynth to the denuded cutis of the abdomen.[7] It is a popular custom in Italy and some parts of Spain to apply poultices made with garlic, wormwood, and

[1] STRUMPF, Handbuch, ii. 279.
[2] Apparat. Med., i. 584.
[3] WIBMER, ii. 227.
[4] ORFILA, Toxicologie, ii. 110.
[5] BECK'S, Med. Jurisp. (6th ed.), ii. 518.
[6] Lancet, Feb. 1868, p. 158.
[7] DIEU, Mat. Méd., iii. 539.

colocynth, to the abdomen, to cause the expulsion of intestinal worms.[1]

Uses.—It is difficult to estimate with accuracy the value of colocynth as an ordinary purgative to overcome *constipation*, because it is seldom or never administered alone, but is nearly always associated, under the form of an *extract*, with aloes and scammony (as in *Ext. Colocynth. Comp.*), with jalap, calomel, and gamboge (as in *Pil. Cathart. Comp.*), or with rhubarb. These compounds are extremely convenient and efficient in cases of obstinate constipation, when more bulky medicines would very probably be rejected by vomiting. Colocynth has been much used as a *vermifuge*. An example has already been cited, but the medicine does not appear to have any specific power of destroying intestinal worms. As a hydragogue cathartic it is sometimes useful in *dropsy*, provided the strength of the patient enable him to sustain its debilitating influence. It has also been prescribed by Hufeland[2] with a view to a diuretic operation, which there is no evidence of its possessing; for, as he administered a decoction of it in beer, whatever diuresis ensued may fairly be attributed to a property of the vehicle. In *coma*, *apoplexy*, and *paralysis*, so far as these affections are susceptible of relief by a derivation upon the bowels, colocynth will often be found useful as an active cathartic. In paralysis of the bladder, for which it has been especially recommended, the local irritant action of the remedy upon the rectum may perhaps combine with its evacuant properties in attaining the object proposed. It has been employed successfully as a cathartic in *melancholia* and other forms of mental derangement depending upon, or at least connected with, torpor of the intestinal canal. Chrestien professed to have cured *mania* by frictions of the abdomen with a solution of the extract of colocynth. He affirmed that it produced diuresis as well as purged.[3] This medicine, like other drastic purgatives, was anciently resorted to, and is still used, to promote the return of *suppressed menses*, as well as with the criminal purpose of producing abortion. Either of these results it may sometimes bring about, but the danger of committing a double crime in the latter case, and of occasioning violent symptoms in the former, ought to be sufficient to dissuade from its use generally in amenorrhœa, and universally in pregnancy. Like various other purgatives, colocynth has been found useful in subacute *gonorrhœa*, or after the acute stage of the ordinary form.

Administration.—Colocynth, or its extract, is seldom administered alone, but nearly always in such combinations as are supposed to mitigate the severity of its operation. As a *stimulant* to the digestive organs the pulp is recommended (*Richter*) to be given in doses of from one-eighth to one-half of a grain, and gradually increased until the urine becomes more copious, or some looseness of the bowels supervenes. As a *laxative* the dose is from two to five

[1] TROUSSEAU, and PIDOUX, Mat. Méd., ii. 716.
[2] RICHTER, Ausfürl. Arzneim., ii. 363. [3] Ibid., p. 354.

grains, and as a *drastic* purgative from five to ten grains, three or four times a day. "It is best administered in a state of minute division, effected by trituration with gum or farinaceous matter." Of the alcoholic *extract* of colocynth the average dose is about five grains. It may be applied *endermically* to the epigastrium, after having been dissolved in alcohol and incorporated with lard. The *compound extract* described above is an excellent purgative in cases of constipation attended with torpor of the liver, and whenever copious evacuations from the bowels are desired. It forms the basis of the compound cathartic pill, which contains, in addition, extract of jalap, calomel, and gamboge, and which may be given in the dose of about ten grains, or three pills.

JALAPA.—Jalap.

History and Description.—Jalap was first introduced into Europe about the year 1610, and before the end of the seventeenth century from five to ten thousand pounds' weight of it was every year imported into Marseilles alone. It is the root of the *Ipomœa Jalapa*, or according to others, of *Exogonium Purga*. These plants are natives of Mexico. The former derives its name from the city of Xalapa, in the neighborhood of which it grows, at a height of about six thousand feet above the level of the sea. When dried, jalap is a roundish, somewhat pear-shaped tuber, smaller than the fist, blackish externally, but grayish-white internally, and presenting a shining undulated fracture containing many resinous points. It has a heavy, nauseous smell, and when fresh, a sweetish and acrid taste. The powder "is of a yellowish-gray color, and, when inhaled, irritates the nostrils and throat, and provokes sneezing and coughing." Its active properties depend upon a resin (*jalapin*).

The following are officinal preparations of jalap:—

Extractum Jalapæ.—*Extract of Jalap.*

This extract is prepared by exhausting powdered jalap in a percolator by means of alcohol and water. It is of a dark-brown color, and is slightly tenacious unless perfectly dry. Its dose is from ten to twenty grains.

Pulvis Jalapæ Compositus.—*Compound Powder of Jalap.*

This consists simply of one part of jalap to two parts of bitartrate of potassa, rubbed together. Dose, from ten to thirty grains. The purgative effect of the mixture may be increased by using a larger proportion of jalap.

Resina Jalapæ.—*Resin of Jalap.*

A concentrated tincture of jalap is first obtained by percolation, and from it the resin is precipitated by water. Dose, five grains.

Tinctura Jalapæ.—*Tincture of Jalap.*

This is a simple tincture made with six troyounces of jalap and two measures of alcohol, with one of water, so as to procure two

pints of tincture by percolation. It is seldom used except as an addition to other purgative tinctures, etc. It may be prescribed in the dose of one or two fluidrachms.

Action. *On Animals.*—Wepfer found that ten grains of the resin of jalap, given to a young dog, produced giddiness, vomiting, and purging. The animal was then killed, and the mucous membrane of its stomach and rectum found to be injected. The experiments of Cadet de Gassicourt[1] on dogs show that moderate doses of this substance produce severe colic, and thin evacuations mixed with mucus and bile, and that larger doses occasion vomiting and profuse diarrhœa, with inflammation of the stomach and rectum, and even death. Made into an ointment and rubbed upon the shaven skin of a dog, it is said to have produced diarrhœa with tenesmus and bloody stools. When given to horses in large doses, jalap sometimes acts as a purgative, but experiments with it upon these animals have not yielded very uniform results. In some cases the discharge of urine was increased, in some the animals were purged, in one gastritis and death followed, and in others little or no effect was produced.

On Man.—Jalap is thought to hold a middle place as a purgative between gamboge and senna, and closely to resemble scammony in its action. When chewed it is apt to produce a flow of saliva and an acrid sensation in the fauces. Murray says[2] that daily experience proves it to be a safe and efficacious purgative in chronic diseases, although, in consequence of the variable proportion of resin which it contains, the effects are somewhat uncertain. He adds that it is best suited to persons of lax fibre, and agrees with Wedel that it may be advantageously used as a purgative even for the youngest children, and for persons advanced in life. The peculiarities of jalap as a cathartic have been accurately described by Wedekind.[3] The nausea, he remarks, which jalap often occasions shows that it is not without an irritant action upon the stomach, but as this is transient, and the stools which speedily follow are watery, its operation appears to be expended upon the intestines, and, indeed, upon their glandular element. The copious secretion which it excites dissolves and dilutes the fæces. Its rapid action and the character of the discharges suggest the belief that it is at first absorbed into the blood and is afterwards secreted from the bowels; and this is the opinion of the most recent investigators of the subject.[4] It does not, however, appear to communicate its cathartic properties to the milk of nursing women, nor to be absorbed by the skin. The form in which Wedekind used the medicine was the following: ℞.—Resinæ jalapæ gr. xxx; pulv. lycopodii gr. v; saponis medicin. gr. xc; amygdal. dulc. excorticarum gr. cxx.—M. exacte triturando. Ft. pil. cxx. Consp. pulv. lycopodii.

[1] Wibmer, Wirkung, etc., iii. 181. [2] Apparat. Med., i. 758.
[3] Beiträge zur Erforschung, etc., p. 83. Compare Bernatzik, Prager Viertel-jahrs., lxxxiv., Anal. p. 14.
[4] Headland, on Medicines, p. 84.

Four of these pills contain only one grain of the resin of jalap. Two of them are sufficient to produce one copious stool, four of them three or four stools, and eight of them seven or eight liquid discharges, in a healthy condition of the bowels. In many cases a single pill suffices for one evacuation. Soon after being taken, slight nausea and a movement in the stomach are perceived. Within a quarter of an hour more, a like sensation is felt near the centre of the abdomen; in another half hour it is experienced near the cæcum, followed by movements in the transverse colon, with slight colic and flatulent rumbling, and in two hours from the commencement there is a disposition to go to stool. Whether one, two, or eight pills were taken, they operated within the same space of time or not at all. The first discharge was generally thick, but mixed with liquid, and had rather a sour smell. The daily and habitual use of the jalap did not appear to lessen its effects. The operation even of large doses (*e. g.*, eight or ten pills) seldom continued longer than two hours, nor did it, like that of aloes, produce any excitement, but, on the contrary, the pulse and animal heat subsided during its operation, and the appetite was but temporarily diminished. The medicine always acted with less energy when the bowels were affected with cramps or pain. It did not, like aloes, aggravate hæmorrhoidal symptoms nor increase a tendency to uterine hemorrhage. The experiments of Willemin[1] agree with the foregoing in proving that the number of stools produced by the resin of jalap is not proportioned to the dose of it administered. Thus, eight grains procured, on an average, three stools, and fifteen grains an average only of four.

Uses.—The forms of *constipation* which jalap is best adapted to relieve are the accidental without colic, and the habitual with dryness of the intestines. In the latter a small dose of jalap, or of its resin, which is preferable, should be taken before rising in the morning, and an hour afterwards a glass of cold water. Wedekind, who recommends this method, adds that when the secretion of bile is deficient, an aloetic pill may also be taken the night before, so that its operation, which does not occur sooner than at the end of eight or ten hours, may coincide with that of the jalap. He states also that the combination is a very useful one for travellers and for those persons whose sedentary habits dispose them to torpor of the bowels.

Many cases are on record to attest the virtues of jalap as a *vermifuge* for tapeworms as well as lumbricoid worms. As early as 1788, Bloch made use of this, in conjunction with other medicines, as a vermifuge.[2] Wedekind was of opinion that it not only expelled intestinal worms, but also destroyed them as a poison. Bremser says that jalap is indisputably one of the most powerful and efficient of purgatives, and one which, perhaps beyond all

[1] Archives Gén. de Méd., 4ème sér., xiv. 441.
[2] Traité de la Génération des Vers.

others, has most decidedly anthelmintic properties. Wepfer and Van Swieten both used it successfully.[1]

Margrave called jalap *panacea hydropicorum*. It is not excelled by any medicine of its class in the power of evacuating *dropsical effusions*, and of curing those which are independent of an organic lesion. Associated with bitartrate of potassa it forms a safe and certain hydragogue cathartic. Sydenham, who thought that *gonorrhœa* is best cured by purgatives, gave a preference to the most drastic, and especially to jalap, after reduction of the inflammatory symptoms by salines.[2] But since he assigned five or six weeks as the ordinary duration of the cure by this method, there is little encouragement to imitate his practice.

Administration and Dose.—The dose of *jalap* is from *fifteen to thirty grains*. The powder should be very carefully triturated with sugar, and some aromatic added to the mixture. By this expedient its action is rendered more certain. Ten grains of jalap and as many of calomel are frequently associated as a purge in biliary disorders, at the commencement of autumnal fevers in cerebral congestions, etc. An excellent hydragogue cathartic, much used in dropsy, consists of from sixty to one hundred and twenty grains of bitartrate of potassa with ten or fifteen grains of jalap. The *extract*, being made with water as well as alcohol, contains both gum and resin. It has no advantage over the powdered root, but is generally prescribed in about one-half the dose. The *resin* is reckoned to be from two to four times as strong as jalap itself, and may be given in does of about *five grains*. It should be thoroughly triturated with sugar, almond emulsion, or some other proper substance, in order to promote its subdivision. The syrup of rhubarb is said to have the property of completely dissolving it, so as to favor its operation in a remarkable degree.[3] The old *tincture* of senna and jalap (*Elixir salutis*), which is prepared with aromatic seeds, may be given as a purgative, in the average dose of *half an ounce*, when the digestive powers are enfeebled by too stimulating a diet. It is no longer officinal.

SCAMMONIUM.—Scammony.

Description.—Scammony is the concrete juice of the root of *Convolvulus Scammonia*, a native plant of Syria and the adjoining countries. It comes in masses or cakes of a dark olive or slate color on their external surface, but somewhat lighter within. It is pulverizable, almost insoluble in water, with which it forms a milky and somewhat greenish emulsion, is rather more soluble in vinegar, and still more so in ether, alcohol, or a solution of potassa. It has a strong and peculiar odor, which has been compared to that of old cheese, and when held in the mouth for some time it has a slightly acrid taste.

[1] Ueber lebende Würmer, etc., 1819, p. 163.
[2] Works, ed. Syd. Soc., ii. 38.
[3] Bull. de Thérap., xxvi. 488.

Resina Scammonii.—*Resin of Scammony.*

From a tincture prepared by percolation and concentrated the resin is precipitated by water. The dose is from five to twelve grains. It is best administered by being rubbed up with unskimmed milk, in the proportion of seven grains of the resin to three fluidounces of milk.

History.—It has been questioned whether the scammony (σκαμμώνιον) of Greek physicians was the same as our own. Dr. Adams says that without doubt it was.[1] They employed it in febrile as well as non-febrile affections, when the stools were bilious, etc. Pliny[2] describes it as a cholagogue, alludes to its griping operation, and recommends its combination with aloes. Celsus[3] speaks of it as a remedy for tapeworm. Dioscorides states[4] that it purges mucus and bile; that to increase its action black hellebore may be associated with it; that boiled in vinegar and mixed with barley flour it forms a useful poultice in sciatica; that a tampon saturated with its juice destroys the fœtus in utero; and that prepared with vinegar it is used as a local application in cutaneous diseases. Hobaisch speaks of its causing borborygmi, colic, and excoriation of the bowels, to which a later Arabian writer adds cold sweats, syncope, and sometimes even death.[5] Others of the early writers, and in particular Mesue, dwell upon the irritating properties of the medicine, and the danger of its causing superpurgation, which they advise to guard against by associating with it gums, oils, mucilage, etc.[6]

Action. *On Animals.*—The results of experiments upon animals with this substance are contradictory. Those of Orfila[7] upon dogs show that it acted as a purge, and the animals died in the course of six or seven days. According to Ollivier,[8] the resin of scammony is almost without action upon dogs, unless it is given in very large doses: it then inflames the bowels, but causes no evacuations.

On Man.—Willemin[9] observed the effects of one hundred and thirteen doses of scammony and of fifty-one of its resin, prescribed by Rayer. The quantity of the former in each dose varied from three to twenty grains. In doses of from three to eight grains the effect was slight; or on an average two stools. Doses of from fifteen to twenty grains occasioned no more. They seldom gave rise to colicky pains. The resin was prescribed in doses of from four to twenty grains. It was more uncertain in its action than the gum-resin, and, all things considered, was evidently less active than the latter, unless it was very finely divided by trituration or solution. In that case eight grains of the resin appeared to have about the same effect as fifteen of scammony. Beyond the dose of fifteen grains, the effects of both preparations were very nearly the

[1] Comm. on Paul. Æginet., iii. 341.
[2] Hist. Nat., xxvi. 38.
[3] On Medicine, iv. 17.
[4] Mat. Med., lib. iii. cap. 145.
[5] Ebn Baithar, ed. Sontheimer, ii. 27.
[6] Matthiolus, Comment., p. 453.
[7] Toxicologie, ii. 155.
[8] Archives Gén., xvi. 141.
[9] Ibid., 4ème sér., xiv. 425.

same. In the time required for it to operate, in the character and number of the stools, the colicky pains produced, and the diminution of the effect when doses of more than fifteen grains were given, scammony displays a very close analogy to jalap. It is more apt than the latter to produce heat of the rectum, and tenesmus. As scammony is nearly insipid, it is administered more readily than jalap to children and squeamish persons.

Uses.—Scammony is seldom used alone, but may be so in cases of great torpor of the bowels, when a derivation upon them is intended to be made from the brain or some other remote organ. It is most frequently associated with calomel, which renders the discharges very copious, and, it is supposed, tends to unload the portal circulation, and relieve the abdominal organs from congestion. This combination is also useful as a *vermifuge*. Scammony is sometimes conjoined with jalap, but the advantage of uniting two substances so nearly identical in their action is not very apparent.

Administration.—The dose of ordinary commercial scammony as a purgative is from *ten to twenty grains*. Of pure scammony, or of its resin, the dose is from *five to fifteen grains*. It should be made into an emulsion with milk, almonds, mucilage, or other demulcent, and sweetened. It may be given in pill, but is less active in that form. It is an ingredient of the compound pills of colocynth.

GAMBOGIA.—GAMBOGE.

Description.—Gamboge is a gum-resin, derived from *Garcinia morella*, var. *pedicellata*, a tree which grows in Ceylon and the Indian Archipelago. It is obtained by incisions made in the bark of the trunk, twigs, and leaves of the tree, and is allowed to harden upon these parts, or is collected in cocoa-nut shells, or in the hollow of bamboo stems. This substance is brittle, and has a conchoidal fracture, the surface of which is somewhat shining, and of a reddish-yellow color. In the mouth, its taste is not at first perceived, but if retained for some time, it makes an acrid impression, and renders the fauces dry. It stains the saliva yellow, is inodorous and inflammable, burning with a white, sparkling flame, and abundant smoke. It is entirely soluble in alcohol and ether, and is precipitated by water from these solutions.

Gamboge is a constituent of *Compound Cathartic Pills*, of which three, or about ten grains of the mass, are an active purgative dose, and of which gamboge forms less than a tenth part.

History.—Gamboge became known in Europe in the year 1603, through Clusius, who received some of it from Cochin China. Its source was indicated by a Catholic missionary in that country, who also described the mode of preparing it. The officinal name is said to be derived from the province, Cambodia, in which the drug is collected. The natives make use of it as a pigment, as an emeto-cathartic medicine, and also as a hydragogue in dropsy. The fe-

males resort to it as a means of procuring abortion.[1] After its introduction into Europe, gamboge was employed in congestion of the brain, jaundice, rheumatism, and other diseases in which a powerful purgative action was thought useful; but the harshness of its operation soon caused it to be laid aside, or used only as an adjuvant to other purgatives. By some it was associated with acids, which were supposed to mitigate the severity of its action.

Action. *On Animals.*—The effects of gamboge vary considerably in different animals, and also in the same species according to its dose and mode of administration. Flohrmann found that fifteen grains given to a horse two years old produced malaise, agitation, a frequent pulse, twitching of the muscles, distension of the abdomen, thin alvine discharges, and trembling of the whole body. Viborg gave an ounce to a nine months' foal, producing eleven evacuations within four hours, while a like dose administered to a horse had no effect whatever.[2] The last-named experimenter, and also d'Aubenton, found that sheep were purged by from twenty to sixty grains, and that two drachms were often fatal. Drachm doses caused vomiting and purging in dogs, but if the œsophagus was tied, the animal only made straining efforts, trembled, grew faint, and was purged. In an experiment of Orfila,[3] half an ounce caused efforts at vomiting, but *did not purge*, and the animal died within twenty-four hours without any active symptoms whatever. In such cases the mucous membrane of the stomach, as well as of the rectum, was reddened, but not disorganized. When finely powdered, and applied to a wound in considerable quantity, gamboge appears to produce local inflammation, and death without signs of pain, and without vomiting or purging. These experiments are very far from rendering clear the *modus operandi* of gamboge. The immediate phenomena, both local and general, and the lesions found after death are insufficient to explain the fatal result. Few of the symptoms which a local irritant produces are displayed; there is but little expression of pain, and seldom either fever, convulsions, or coma, so that the action of the medicine must be regarded as very obscure, and different from that of the drastic purgatives with which it is classed.

On Man.—A. L. Richter found that when applied to the skin, gamboge produced no effect while the cuticle was whole, and that when the latter was removed it acted simply as a local irritant, causing a secretion of fibrin, and a sore which healed with difficulty.[4] Taken internally, and in small doses, it acts as a stimulant to the abdominal organs, augmenting the secretion of the glandular apparatus; in larger doses it purges, generally causing severe colicky pain and tenesmus, and often vomiting besides. Rayer observed the effects of this substance upon persons who either had no acute disease or were convalescent from sickness.[5] It was first

[1] MURRAY, App. Med., iii. 110 and 654.
[2] WIBMER, Wirkung, etc., ii. 388.
[3] Toxicologie, ii. 112.
[4] STRUMPF, Handbuch, ii. 286.
[5] Annales de Thérap., iv. 256.

given to fifteen persons, in doses of five grains each. All of them vomited bile within an hour or an hour and a half, and had from two to six stools with little or no colic. There were no symptoms of local inflammation or general fever. The reduced dose of three and a half grains was afterwards given, and occasioned slight nausea, but no vomiting, and from two to six stools, with slight colic or none at all. When gamboge is treated with alcohol, there remains undissolved a gummy residue of a bitter and acrid taste, but, according to Krahmer, without sensible action upon the intestinal canal in doses of thirty-five or forty grains. The alcoholic extract, on the other hand, which constitutes 85 per cent. of the original mass, is purgative in a dose of four grains. In Krahmer's experiment on himself, it did not occasion nausea, but moderate pain in the colon, and produced two large fæcal and mucous stools.[1] Several writers have attributed a diuretic operation to gamboge. This quality was long ago pointed out by Lewis,[2] who says: "Solutions of gamboge in alkaline water . . . . act only by stool and urine." Abeille found[3] that when given in small but gradually increasing doses until it reached the quantity of about twenty grains a day, it no longer purged, but seemed to produce copious diuresis, and the evacuation of dropsical effusions, for the removal of which it was prescribed. This agrees with Ferriar's experience given below.

It is usually stated that large doses of gamboge have proved fatal. After a diligent search for the foundation of an assertion so confidently made and so often repeated, we have discovered none except a single case published a hundred and eighty years ago by Paullinus.[4] It seems that a barber surgeon administered a drachm of the medicine, for what purpose is not stated, and produced violent vomiting and purging, with fainting and "six hundred other mischiefs which deserve to be mourned with tears of blood." The patient, however, did not die immediately, but after some time and much suffering perished. In all of the fatal or imminently dangerous cases attributed to the action of gamboge the effects appear to have been produced by excessive doses, not of gamboge, but of certain quack pills, of which aloes and colocynth as well as gamboge, and perhaps other substances still more acrid, were constituents. The most definite notions of the operation of gamboge in disease are presented by the results of Rasori's experiments.[5] The views of this author were originally published in 1807, and are contained in the following proposition: "A disease distinguished by certain symptoms, and an agent having the property of producing like symptoms being given, the latter, instead of aggravating the disease, will remove it, provided that the remedy be in opposition to the existing diathesis."[6] After showing that nearly all preceding

[1] Journ. f. Pharmakodynamik, ii. 547.
[2] Mat. Med., i. 458.
[3] Bull. de Thérap., xxxvii. 329; xxxviii. 275.
[4] Ephemer. Natur. Curios., Dec. 1, Ann. viii. p. 139.
[5] Opuscoli di Med. Clin., ii. 73.
[6] This doctrine, which is nearly identical with that of Hahnemann, was evolved quite independently of the latter, and led to a far different, and, indeed, diametrically opposite, method of therapeutics.

writers regarded gamboge as a violent and dangerous remedy, Rasori relates a number of cases in which he employed it for the cure of diarrhœa and dysentery, in doses of from five to twenty grains in twenty-four hours. They seldom excited vomiting and never colic; but, on the contrary, relieved the latter symptom if it was present. Identical results have been published by Castiglione,[1] who, like Rasori, insists upon the fact that the medicine is much more readily tolerated when the bowels are inflamed than when they are in their natural condition. This assertion is directly opposed to the general belief of physicians.

Uses.—Gamboge is recommended in obstinate *constipation* connected with congestion of the liver or spleen, and serving directly either to cause jaundice or to prolong intermittent fever, etc. It is, however, seldom given alone, but either with calomel, which is said to render its action much milder, or combined with other resinous cathartics, as in the compound cathartic pills.

Many writers might be cited in proof of the efficacy of gamboge in *dropsy*, and particularly in *anasarca*, although some insist upon its efficacy in *ascites* also. Nearly all of them admit the extreme harshness of its action, and seem solicitous to devise means of correcting this objectionable quality. The greater number caution against its use in atonic dropsy, as well as when the patient is feeble; but some, like Werlhof, insist upon its superiority to other cathartics, whatever may be the state of the patient's strength. Cullen, who was led to abandon the exhibition of the medicine in full doses on account of the severity of its operation, found it very effectual when given in divided doses. "Observing," he says, "that it was a purgative which passed through the intestines more quickly than almost any other, I have judged that moderate doses of it might be repeated soon after one another with more safety and with more effect than by giving large doses at once. Accordingly, I have given doses of three or four grains, rubbed with a little sugar; and repeating these every three hours, I have found it operate without vomiting or griping; and, at the same time, after three or four such exhibitions, a great deal of water was evacuated both by stool and urine."[2] Ferriar, in speaking of remedies for dropsy, uses the following language: "After a long and extensive experience of the qualities of gamboge, I can recommend it as one of the gentlest, most certain, and least nauseous laxatives in the materia medica. Being nearly free from either smell or taste, it is particularly well adapted to the management of children, with whom its anthelmintic power is likewise valuable. A very commodious form of exhibiting it is a solution in distilled water, in the proportion of half a grain of gamboge to half an ounce of water. A tablespoonful may be given to an adult every hour till it operates. A teaspoonful of the solution, given in the same way, is a dose for a child under twelve years of age. When given in this manner, doses of seven or eight grains have been found neces-

[1] Annales de Thérapeutique, iii. 444. [2] Mat. Med., ii. 545.

sary to move the bowels, and it has proved strongly diuretic."[1] Most generally it is associated with other purgatives, and especially jalap and bitartrate of potassa, but the advantage of such a union is perhaps overrated.

Gamboge has also been used as an *anthelmintic*, and particularly as a remedy for tapeworm; and not a few of the most reliable authorities attribute to it a high degree of efficacy. It formed an ingredient of Madame Nouffer's specific for tapeworm. Werlhof, Bissett, and others regard it as a specific against this and other species of intestinal worms, but Bremser did not consider it a true anthelmintic.[2] Indeed, it does not appear to possess any specific virtues, but to act only as a powerful cathartic, after the administration of calomel, wormseed, pinkroot, male fern, or some other substance capable of exerting a directly poisonous influence upon the worms.

Administration and Dose.—The best mode of administering gamboge alone is that recommended by Cullen, to give three or four grains of it rubbed up with a little white sugar every three hours; or that proposed by Ferriar, to give half a grain every hour in solution. By these means it seldom occasions vomiting, and yet purges freely. The full purgative dose is generally stated at *ten* to *fifteen grains*, but this we regard as excessive. From *one* to *five grains* is nearer the proper average dose. When given in pilular form its action is retarded and impaired. The alkaline solutions above referred to may be prepared as follows: ℞.—Gamboge, gr. x; solution of carbonate of potassa, ℥ss; cinnamon water, f℥j.—Mix. S.—Twenty to thirty drops in water three or four times a day; or ℞.—Gamboge, ℥ss; carbonate of potassa, ʒj; brandy, Oj.—Mix. Dose, one or two fluidrachms. (*Oesterlen.*)

ALOE.—Aloes.

Description.—Aloes is the inspissated juice of several species of aloe. The plants which furnish this medicine belong to the natural family of *Liliaceæ*, and are very widely disseminated. They abound upon the shores of the Mediterranean and of the Red Sea, at the Cape of Good Hope, and in the East and West Indies. They are usually from one to two feet in height, and have fleshy, ensiform leaves armed on the edges with spines or serratures. The aloes of commerce is obtained by evaporating the juice which exudes from transverse incisions made in the leaves, or from the footstalks of the latter when they are torn from the stem. The principal commercial and officinal varieties are the following: 1. *Socotrine* aloes (Aloes Socotrina), also known as *Indian* aloes; *Turkey* aloes is furnished by *A. socotrina*. The hardened portions are of various colors. Sometimes they are of a garnet red, some-

[1] Med. Histories (Am. ed.), p. 217.
[2] Ueber lebende Würmer, etc., p. 164.

times of a pale or golden red, and, when powdered, of a bright yellow color; their fracture is vitreous and generally conchoidal; the odor of the freshly-broken pieces, especially when breathed upon or heated, is very fragrant, and the taste is bitter and somewhat aromatic. 2. *Cape* aloes (ALOES CAPENSIS), the inspissated juice of the leaves of Aloes spicata, is the most abundant variety of the drug. By the German writers it is called *shining aloes.* When freshly broken it has a very dark olive or greenish color, approaching to black, presents a smooth, bright, almost glassy surface, and, if held up to the light, appears translucent at the edges. The powder is of a fine greenish color. The odor is strong and disagreeable, but not nauseous, nor, on the other hand, aromatic. 3. *Barbadoes* aloes (ALOE BARBADENSIS) is the inspissated juice of the leaves of *A. vulgaris.* It is of a dark brown or blackish color, and sometimes of a reddish brown or liver color; the fracture is generally dull, the taste nauseous and bitter, and its odor, which is unpleasant, is rendered still more so by breathing upon it. The powder is of a dull olive-yellow color.

Aloes contains a *bitter* principle called *aloesin* (but which is probably a compound of several proximate principles), a peculiar *resin,* and an acid having a close affinity to gallic acid. It is soluble in alcohol, ether, and boiling water. Messrs. T. and H. Smith obtained from aloes a substance which they regard as its cathartic principle, and which they term *aloin.*[1] It is crystalline and soluble in alkaline liquids and hot alcohol. It operated as a purge in doses of one or two grains.

The officinal preparations of aloes are very numerous, but the following are the most important:—

EXTRACTUM COLOCYNTHIDIS COMPOSITUM.—*Compound Extract of Colocynth.* Vid. *Colocynth.*

PILULÆ ALOES.—*Pills of Aloes.*

Socotrine aloes and soap are combined in equal parts. Each pill contains two grains of each of the ingredients. Dose, as a cathartic, five pills; as a laxative in habitual costiveness, one or more pills.

PILULÆ ALOES ET ASSAFŒTIDÆ.—*Pills of Aloes and Assafetida.*

In these pills, aloes, assafetida, and soap are united in equal parts, and each one should contain about four grains of the mass. From two to five pills are a purgative dose.

PILULÆ ALOES ET MASTICHES.—*Pills of Aloes and Mastic. Lady Webster's Pills.*

One part each of mastic and red rose, in fine powder, are beaten into a mass with four parts of socotrine aloes, and divided into pills of three grains each. Dose, as a laxative, one or two pills.

PILULÆ ALOES ET MYRRHÆ.—*Pills of Aloes and Myrrh.*

One part of aromatic powder, two of myrrh, and four of aloes, with syrup in sufficient quantity, form these pills, known as *Rufus's*

[1] Month. Journ. of Med. Sci., Feb. 1851, p. 127.

pills, and much used in amenorrhœa. Dose, from ten to twenty grains.

PULVIS ALOES ET CANELLÆ.—*Powder of Aloes and Canella; Hiera Picra.*

One part of canella mixed with four parts of aloes forms this popular remedy for amenorrhœa and constipation. Dose, ten to twenty grains.

TINCTURA ALOES.—*Tincture of Aloes.*

This is a solution of one troyounce of aloes and three troyounces of liquorice in half a pint of alcohol, and a pint and a half of distilled water. After maceration, it is filtered. Dose, from half a fluidounce to a fluidounce and a half.

TINCTURA ALOES ET MYRRHÆ.—*Tincture of Aloes and Myrrh; Elixir Proprietatis.*

Two pints of tincture are procured by percolation with alcohol from powdered socotrine aloes and myrrh, of each three troyounces, to the production of two pints of tincture. Like the pills of aloes and myrrh, it is adapted to torpid conditions of the bowels and of the uterine system, but, owing to the alcohol it contains, is more stimulant than the pills just named. Dose, from one to two fluidrachms.

TINCTURA BENZOINI COMPOSITA.—Vid. *Expectorants.*

VINUM ALOES.—*Wine of Aloes.*

This wine is made with socotrine aloes, in fine powder, a troyounce, cardamom and ginger, powdered, of each sixty grains, and sherry wine, a pint. After maceration for seven days, with occasional agitation, it is filtered through paper. It is a warm laxative and cathartic in the dose of from half a fluidounce to two fluidounces.

History.—Pliny gives a description of the aloes plant and of its concrete juice.[1] He says of the latter that "it is chiefly used to open the bowels, and of all cathartics is almost the only one which is at the same time stomachic and aperient, so free is it of all mischievous operations upon the stomach." He states that it is most active when taken before a meal, and that in dyspepsia it is to be used after eating. He describes many external uses to which it is adapted; for instance, it relieves headache when it is applied with vinegar to the temples, and its vinous tincture prevents the hair from falling out; it is mixed with honey as a stimulant in ophthalmia, to cleanse ulcers of the mouth and throat, to promote the healing of wounds and sores of the penis, anus, etc. The description of Dioscorides is almost identical with that of Pliny, and Galen does little more than copy it. Mesue states that aloes aggravates piles and inflammations about the anus. Nearly all of the

[1] Hist. Nat., xxvii. 5.

writers mentioned, as well as those of the Arabian school, attribute to aloes a special power of purging off the bile, and curing affections of the abdomen and of the head supposed to depend upon derangement of this secretion. Some of them praise it as a topical application to condylomata and external piles, and in those affections for which Pliny recommends it. Nearly all agree with Mesue in the statement that when taken internally it is apt to create or to aggravate hæmorrhoids, and several insist upon its combination with other laxatives in order to obviate this effect.[1]

Action. *On Animals.*—Experiments on horses, oxen, sheep, swine, and dogs, show that aloes acts upon these animals as a slow but certain cathartic. It is very commonly employed in veterinary medicine. The dose usually given to horses is from five to seven drachms, and it operates in from eighteen to twenty-four hours. Moiroud injected a solution of four drachms of aloes into the veins of a horse, but no purgative effect ensued. The discharge of urine was thought to be increased.

On Man.—Several ancient writers state that aloes acts as a purgative when rubbed upon the skin.[2] Wedekind says that an ointment made of aloes and ox-gall and applied by friction, purges. Monro noticed this effect from the application of aloes to a carious ulcer, and others have observed it when it was used to promote the discharge from an issue. Dr. Gerhard, of Philadelphia, found it the medicine best adapted for endermic uses, as its application does not irritate a blistered surface very powerfully. Ten grains of it thus employed produced five or six stools, which were generally accompanied with griping.[3] Infants are purged by the milk of nurses who have taken aloes.

In very small doses aloes operates as a gentle stimulant to the stomach and bowels, increasing the appetite and promoting digestion. Fallopius states that two grains will cause an evacuation, but only after the lapse of twenty-four hours, and that a scruple is necessary to procure watery dejections.[4] Cullen makes an almost identical statement, and adds that the stools appear to consist merely of what may be supposed to have been present in the large intestines, but that doses of more than twenty grains produce liquid stools, with pain and griping. He regarded the medicine as a mere evacuant of the fæces, producing its effect very slowly, and by means of its specific action upon the colon and rectum.[5] These views have acquired strength and precision from the experiments of Wedekind and of Giacomini. The former concluded[6] that the primary action of aloes is to augment the biliary secretion, and its secondary effect, or consequence of the former, is to purge. This general result is in exact conformity with the conclusions of the ancient, and especially of the Arabian writers. The more particular results obtained by Wedekind are these: After a dose of from four

[1] EBN BAITHAR (ed. Sontheimer), ii. 120.
[2] MURRAY, Apparat. Med., v. 251.
[3] N. Am. Med. and Surg. Journ., x. 155.
[4] MURRAY, op. cit., p. 252.
[5] Mat. Med., ii. 525.
[6] Beiträge zur Erforschung, etc., p. 60.

to eight grains of aloes, neither nausea nor any other disturbance is perceived, except, perhaps, some eructation, and occasionally warmth and uneasiness in the region of the liver, before the commencement of the purgative operation. The latter seldom begins in less than from eight to twelve hours, and the size of the dose has but little influence on the length of this period. The evacuation is sometimes preceded by griping, and several stools succeed one another, accompanied with slight tenesmus. They are feculent and of a natural constitution: but if several follow one another closely, they are bilious and mucous, but never watery nor very abundant. They, as well as the discharged flatus, have a peculiar and characteristic smell. Their number depends more upon the state of the bowels than upon the dose of the aloes. Half a grain will sometimes produce as much effect as ten or twenty grains, and the more the patient is disposed to secrete bile the greater will the effect be. Purging by aloes is stimulant rather than sedative, causing acceleration of the pulse, dryness of the fauces, thirst, scantiness and heat of urine, an unpleasant warmth in the abdomen, and sometimes tension and throbbing in the right hypochondrium. But these phenomena are seldom observed when the medicine is taken in doses of less than four grains as an habitual laxative. Its action is not lessened by habit, on the contrary, it produces the same effect although given in a diminished dose. When a predisposition to hæmorrhoidal or uterine flux exists, aloes is very apt to bring on the discharge, and in varices of the bladder and in dysuria it ought to be avoided. Small doses are apt to increase a tendency to erections and excite the sexual appetite. When other and quickly operating cathartics are taken along with aloes, it does not appear to modify their action; but if it is administered seven or eight hours before a saline purgative, for instance, a combined and very active operation is the result. When it is given by enema, and is retained, it is said by Wedekind to operate at the expiration of seven or eight hours, in the same manner as when taken by the mouth, but without producing irritation of the rectum. If this statement be correct, it would seem to warrant his inference from it that the last named symptom is due not so much to the direct action of the aloes as to the secretion of bile which it induces. But general observation will scarcely sustain this judgment; and it is, moreover, certain that aloetic enemata frequently repeated produce intolerable tenesmus.

The experiments which Giacomini made upon himself[1] are so nearly identical in their results with those just given, as to render a detailed account of them unnecessary. He found that one grain doses taken fasting only produced eructations of a peculiar odor, and that two or three grain doses, besides this effect, occasioned, after the lapse of eight or ten hours, a soft and copious stool of a brownish-yellow color, and characteristic smell. Larger doses did not appear to increase the effects much; fifteen grains, indeed, pro-

[1] Mat. Med., p. 522.

duced no discharge at all, and twenty-four grains taken in two doses occasioned two liquid stools on the following day.

The tendency of aloes to produce hæmorrhoids has already been referred to as having been noticed by ancient writers. In times more nearly approaching our own, the same tendency of the medicine has been insisted upon. Fuchsius was of opinion that of one hundred persons who should take aloes frequently as a laxative, ninety would suffer from piles.[1] Murray blames physicians who are induced by the gentle and certain action of the medicine to expose their patients to so serious a consequence, and Fothergill[2] reprobates its habitual use in menstrual disorders at the critical period for the same reason. It was to this purgative that Fonseca attributed the prevalence of piles among the inhabitants of Padua, and Stahl makes a similar statement in regard to the people of Hamburg. Calvin is cited as a prominent example of this mischief produced by aloes; for the celebrated reformer is said to have died ultimately from the effects of the piles to which it gave rise;[3] but as he was also of frail constitution, subject to quartan ague, gout, and gravel, the part which aloes bore in his demise may reasonably be judged to have been small. Cullen regarded a belief in the tendency of aloes to produce piles as much exaggerated, and to have been suggested by the effects of large doses of the medicine. He considered the costive habit for which the aloes is given, and not the medicine itself, to be the real cause of the disease. Sachs and Dulk make a very similar statement,[4] and add that they have uniformly failed in establishing hæmorrhoids artificially by its means. Trousseau and Pidoux arrived at the same result. Sir B. Brodie's experience confirms these conclusions. He states that from his own observation he could not be certain that aloes is productive of piles at all, and, like Cullen, he attributes this infirmity, not to the medicine, but to the constipation which aloes is used to remove.[5]

From some experiments made by Dr. Garrod to test the question whether the portion of aloes soluble in water differed in its action from the insoluble, or so called resinous, constituent, he concluded that the former is a much more energetic purgative than the latter, and contains in itself nearly all the griping property of the drug.[6] The contrast of this result with that obtained by Krahmer in the case of gamboge is not without interest.

Uses.—Trousseau and Pidoux state that aloes was successfully employed by Esquirol to counteract a tendency to *cerebral congestion* in the insane, and they themselves cured with it cases of *neuralgic headache* which no other treatment relieved. Ollivier found it of sevice in the treatment of certain *paraplegiæ*. Except

[1] MANGETUS, Bibl. Med. Pract., ii. 41. [2] Works, ii. 211.
[3] Dict. de Méd. en 60 vol., xx. 505.
[4] Handwörterbuch der prakt. Arzneim., i. 223.
[5] Clinical Lectures on Surgery (Am. ed.), p. 308.
[6] Times and Gaz., Feb. 1864, p. 146.

so far as these affections were aggravated by constipation, which aloes was fitted to remove, its utility may very well be questioned.

Several modern writers, among whom may be mentioned Janin, Boerhaave, Reil, and Beer, have imitated the ancient method of using aloes for *affections of the eyes*, such as weakness with lachrymation, opacities of the cornea, etc.[1] But as the medicine is in every case recommended to be associated with stimulant or sedative agents, its proper and separate effects must be extremely small.

Aloes is very frequently employed as a *stomachic*, and forms the basis of numerous pills, such as the *Pilules des gourmands*, *Pilulæ ante cibum*, or dinner pills, which have long enjoyed a high repute for their virtues in atonic dyspepsia. The dose ought not to exceed two grains, and should be taken immediately before or after meals.

As a *purgative* simply to overcome *constipation*, this agent is, perhaps, the best of its class. It is unsuitable for persons of a plethoric, bilious, or hemorrhagic constitution, and for pregnant females, whenever the liver is congested or inflamed, when there is general fever, or inflammation of the bowels, and particularly irritation of the rectum from piles. On the other hand, it is especially indicated when the secretion of bile is scanty or suspended, when there is atony of the colon depending upon accidental or constitutional debility, and especially upon the advance of old age, sedentary habits or occupations, and, in females, upon repeated pregnancy. It has already been mentioned that the dose of this medicine need not be increased, but may, on the contrary, be diminished after the habitual use of it. This circumstance renders it invaluable in the cases indicated. Its utility is much insisted upon when the habitual hæmorrhoidal flux has been suspended, but it depends not so much upon the tendency of the medicine to renew the salutary depletion, as to free the bowels of accumulated fæces. There is, too, a form of *piles* which it is said to cure, one connected with an extremely relaxed state of the system, and of the rectal tissue in particular. It has also been recommended as very efficient in removing *ascarides* of the rectum. There are few means of regulating the alvine dis charges which have not the same effect, but it has been asserted, and its bitterness renders it probable, that aloes possesses specific anthelmintic virtues.

Wedekind states that during sixteen years' service in the French military hospitals he had a great many cases of *simple atonic jaundice*, all of which he cured in a week's time by means of aloes alone, and often when saline and other purgatives had failed to give relief. He administered the medicine twice a day in doses of ten grains each, and found that no effect was produced until the stools began to be colored, when a cathartic action was at once manifested. When once the stools became bilious, small doses of aloes were sufficient to maintain a purgative operation.

In imperfection or suppression of the *catamenia*, without congestion of the pelvic organs, aloes is often useful in restoring the

[1] Richter, op. cit., ii. 346.

natural condition of the discharge, if taken a few days before the menstrual period. The greater the torpor of the uterine system, the more appropriate does the use of aloes become, and hence it is most applicable to suppression of the menses in females of a phlegmatic temperament, or who are disposed to nervous or inflammatory disorders. It is not less useful in certain forms of *memorrhagia* which appear to depend upon debility. Eberle says: "This article, given in small doses, but frequent ones, deserves to be accounted the best remedy we possess for those protracted, exhausting, and obstinate hemorrhages from the uterus which occur in women of a relaxed, nervous, and phlegmatic habit, about the critical period of life." This author also employed aloes in conjunction with prussiate of iron, and Dewees used it associated with canella in passive and protracted hemorrhage from the womb. In all cases care should be taken to ascertain that the suppression of the catamenia is not the consequence of pregnancy.

It has been proposed by Sandras[1] to use aloes in the treatment of *gleet*. He found that it may sometimes be cured, within the space of about a week, by pills of two or three grains of aloes taken three times a day. This method might be tried where special objections exist to the use of copaiba or of astringent injections.

Aloetic enemata are reported by M. Aran to be remarkably successful in the treatment of *uterine leucorrhœa* and *catarrh*, while they fail entirely in effecting analogous discharges from the vaginal mucous membrane, and even from the neck of the uterus. It is, however, a condition of its success that this treatment should not be applied in cases which involve an active inflammatory element. From seventy to one hundred and fifty grains of aloes, and as much Castile soap, are dissolved in three ounces of boiling water. This is administered daily, or every other day, at bedtime, after the use of an injection of tepid water. In the most favorable cases it arrests the discharge in the course of from four to six days.[2]

The *cicatrizing* virtues of aloes were, as we have seen, much valued by the ancients, and they have at all times been in the highest popular repute. This is proved by the number of nostrums believed to possess such virtues, and into the composition of which aloes enters, such as Turlington's balsam, Wade's balsam, Friar's balsam, *baume du commandeur*, etc. We have found the first named of these preparations successful in curing varicose ulcers of the legs which no other application seemed to improve. The reality of this virtue has been proved by the observations of M. Chaussit on the glycerole of aloes or a solution of aloes in glycerin. He prepared it by evaporating from four to eight parts of tincture of aloes, and then gradually adding thirty parts of glycerin. He employed it with remarkable success in healing *fissures and excoriations of the skin* caused by lichen agrius, sycosis of the upper lip and nares, eczema, etc. Five or six applications, at most, sufficed to

[1] Bull. de Thérap., xxiv. 16. [2] Times and Gaz., Sept. 1858, p. 303.

heal old and obstinate fissures.[1] A solution of one part (by weight) of aloes in two of alcohol has been found very efficient in the treatment of *bed-sores* and other atonic and indolent *ulcers*, by M. Delioux.[2]

Administration and Dose.—The ancients seem to have prescribed aloes in much larger doses than are now thought proper. One or two drachms were commonly given, and the same quantity is directed by Fallopius. Alston prescribed half a drachm as sufficient. At the present day it is generally acknowledged that little or no increase of effect is obtained by doses of more than *ten* grains. As an evacuant in habitual constipation, a daily dose of *two* grains is sufficient. Its combination with other purgatives adds little or nothing to its efficacy. To unite it in a pill with two grains of rhubarb is illusory, as the latter medicine, in such dose, must be almost or quite inert; to combine it with drastic hydragogue cathartics, which are rapid and energetic in their operation, must be to neutralize its peculiar action. Hence it is best administered *alone*, or merely with soap in the pilular form, or with the bicarbonate of soda or potassa in a mixture, to promote its solution. If, however, it is desired to exercise a depletory action upon the bowels as well as to promote the discharge of bile, or to palliate the irritation which the medicine is apt to create in the rectum, it may be taken at bedtime and be followed by a saline draught in the morning.

Numerous formulæ for the administration of aloes have been proposed, and several of them, which are enumerated at the beginning of this article, are officinal. It is associated with *tonics*, such as gentian or iron; with *antispasmodics*, such as myrrh or assafœtida; with *purgatives*, such as colocynth, rhubarb, gamboge, or simply with soap, in the form of pills; with canella, in the powder known as *Hiera Picra;* with liquorice, carbonate of potash, myrrh, and saffron, in the Compound Decoction of Aloes (*Brit. Ph.*); with saffron and myrrh, in the *Elixir Proprietatis* (Tinct. Aloes et Myrrhæ), etc. etc. Of these, its combinations with rhubarb, with canella, and with myrrh are probably the most important, although, as remarked above, the quantity of the first-named ingredient can add but little to the efficacy of the preparation which contains it, and the utility of the two latter is far from being evident.

OLEUM TIGLII.—CROTON OIL.

Description.—This is the fixed oil obtained from the seed of *Croton Tiglium*, a small tree or shrub which grows upon the continent of India and the Islands of the Eastern Archipelago. The seeds are rather larger than a grain of coffee. Before being pressed they are divested of the internal seed-coat, which is extremely acrid. The kernels are themselves but slightly less so, although their taste

[1] Times and Gaz., Sept., 1858, p. 123. [2] Bull. de Thérap., lxvi. 24.

is at first mild and oleaginous. The burning sensation which they produce is very persistent. Croton oil varies in color from very pale yellow to dark reddish-brown; it has a nauseous and unpleasant odor, and a hot and acrid taste. When pure, it is soluble in alcohol and ether, and in the fixed and volatile oils. It has an acid reaction.

When croton oil is repeatedly agitated with alcohol of 74 per cent., and allowed to stand, the supernatant alcohol becomes intensely acrid, while the oil itself loses nearly all its acrid taste. If, however, the latter is treated with liquor potassæ, it fully regains this quality, which is supposed to depend partly upon a volatile principle, and partly upon an acid called *crotonic*.

History.—The Arabian writers were the first to notice this medicine, under the name of *Dend*. They describe several varieties of it. Honain remarks as a wonderful fact that its active principle is oily. He describes its drastic properties, which, he says, render it unsuitable for use in hot climates. Rhazes mentions the violence of its action, and its occasionally fatal effects, and recommends cold affusions to moderate their force. He alludes also to the irritant action of the seeds upon the mouth when they are chewed, and to the eruption which they sometimes produce. He recommends them to be administered in conjunction with milder purgatives. Isa Ben Ali says that Dend purges violently, and excoriates the bowels, and advises to counteract its irritation with an emetic, followed by butter, milk, and mucilages.[1] The croton seeds were also described by Acosta,[2] under the name of *Pignoli di Maluco*. He says that they are used by the inhabitants of Malabar, in clysters, as a remedy for sciatica and dysuria, and by the mouth as a purge. He adds that water in which they have been infused cures recent impetiginous eruptions, although it causes much smarting.[3] The purgative qualities of the seeds were described by the Dutch naturalist Rumphius, who, about the close of the seventeenth century, lived for many years in Amboyna, one of the Molucca islands. He speaks of the persistent acrid taste of the whole plant, so that chewing a leaf of it causes the mouth and fauces to burn for several days; also of the use of the seeds in the East Indies as a hydragogue cathartic. The writer adds that in Europe the oil is used as a common purge, in the dose of one drop.[4] Hermann alludes to the purgative action of the oil when rubbed upon the abdomen, and Cohausen to the use of the seeds as a remedy for tapeworm.[5] To this statement Murray subjoins that the medicine has gone out of use. Attention was directed to it anew by the publication of Ainslie's *Materia Medica of Hindoostan* in 1813. The descriptions of the properties and uses of the seeds by the native practitioners

[1] Ebn Baithar (Sontheimer), i. 427.
[2] Trattato delle Droghe, etc., 1585, p. 238.
[3] This author subjoins: "Le buone donne anco di quelle parti, amiche de' loro mariti gliene danno fin quattro per bocca, per mandare i pover' uomini all' altro mondo."
[4] Herbarium Amboinense, iv. 98.
[5] Apparat. Med., iii. 149.

correspond very closely with those of the Arabian writers already referred to. They also used the oil as an external application in rheumatism. It was introduced into England in 1820, by Dr. Conwell, who, as well as one or two other East Indian practitioners, published accounts of its operation and uses.

Action. *On Animals.*—The experiments of Landsberg and others upon horses show that these animals are but slowly affected by croton *seeds*, although the symptoms ultimately developed are severe and even fatal. The most striking of them are these: loss of appetite, frequency of pulse, debility, signs of abdominal pain, foaming or unusual dryness of the mouth, grinding of the teeth, short, quick, and laborious breathing, flatulent distension of the abdomen, diarrhœa, tenesmus, followed by paralysis of the rectum, cold sweating, and death. The gastro-intestinal mucous membrane is found injected and softened, and the bowels are filled with a bloody liquid. In these experiments a dose of from ten to forty of the seeds was given, but the latter quantity only was fatal.[1] Orfila gave a dog three drachms of the *seeds*, which had been beaten to a paste, and then tied the œsophagus. In three-quarters of an hour the animal made strong efforts to vomit, and in an hour and a quarter more lay insensible upon his side. In another hour he was dead. The whole intestinal canal was highly injected, and the mucous membrane of the stomach had a dark red color. Other experiments furnished similar results. When the paste was introduced into the subcutaneous cellular tissue, it produced the same general symptoms, but neither vomiting nor purging, and the intestine was not found inflamed.

In Java the seeds are said by Rumphius to be employed for killing fish.

The action of the *oil* upon dogs is very speedy and decided. Conwell found that a single drop given to one of these animals produced a discharge from the bowels within forty minutes; twelve drops caused vomiting, and, on the animal being sacrificed, the whole intestinal canal was found inflamed. Five drops injected into a vein produced vomiting, purging, debility, and, in two hours, death. The gastro-intestinal mucous membrane was highly inflamed.

In three instances, Hertwig injected three or four drops of croton oil into the jugular vein of a horse. Immediately, the respiration became rapid and irregular, the pulse almost imperceptible, the muscles very feeble, and the animal showed signs of pain followed by apparent insensibility. After half an hour, the symptoms remitted, but in the course of three hours more returned again. Death took place in eight hours without there having been any disturbance of the bowels. On dissection, the alimentary tube presented no alteration, but the heart was spotted with ecchymoses, and the pericardium contained a large quantity of bloody serum. The lungs were also much congested.

[1] WIBMER, Wirkung, etc., ii. 222.

The more recent experiments of Bucheim correspond in their results with these. In no instance after injecting croton oil, either pure or from which the free acrid principle had been removed by alcohol, into the veins of an animal, was diarrhœa produced, or inflammation of the intestinal canal excited. Vomiting and the discharge of natural fæces were observed.[1]

On Man.—After chewing one of the *seeds*, which he then spat out, Buchner experienced a prolonged burning pain and constriction of the throat, with sweating of the face. In about an hour afterwards, purging commenced, and eight stools were voided. Lansberg swallowed the half of a croton seed. At first it tasted sweet and oily, but afterwards, and for some time, extremely bitter and acrid; the saliva flowed abundantly; over the whole body, but especially upon the face, there was a sense of heat, and the pulse was quickened; nausea, eructations, distension of the abdomen, and colic followed. In two hours and a half the tongue became coated, a sickening taste was perceived in the mouth, and a burning sensation in the fauces. These symptoms continued until the next day, in the course of which three stools were voided; the urine was increased, and had a clouded aspect. For several days afterwards there was some degree of debility and malaise, with soreness of the gums. The laborers in the Calcutta Botanical Garden are said to be in the habit of taking one of these seeds as a purgative, and on one occasion the dose is reported to have proved fatal.[2] The dust of the dried seeds, when inhaled in large quantities, has been known to produce poisonous effects. In a case related by Pereira, the symptoms were loss of appetite, a burning sensation in the nose and mouth, tightness of the chest, copious lachrymation, and epigastric pain. Giddiness and insensibility followed, and then a burning heat in the throat and stomach with numbness and insensibility of the tongue. The bowels were not moved; on the contrary, they required castor oil to open them. Hot brandy and water and the warm bath appeared to relieve the symptoms, which indeed were all, except the epigastric pain, removed in the course of two or three days.

According to Fossati, croton *oil* given *internally* in the dose of from half a drop to one drop, will produce fifteen or twenty stools, and that "without the least disturbance or pain." It is seldom that such marked effects are observed from so small a dose. In general, a drop given in emulsion or in pill, produces more or less of an acrid and burning sensation in the fauces and œsophagus, and warmth of the stomach, with nausea and sometimes vomiting. In the course of an hour or two some gurgling or slight colic is perceived in the bowels, followed somewhat suddenly by a watery stool which produces tenesmus and heat about the anus. Within twenty-four hours, eight or ten more stools follow, and there is little general disturbance of the economy further than considerable

[1] VIRCHOW'S Archiv, xii. i. [2] PEREIRA, 3d Am. ed., ii. 365.

weakness. According to Sigmond,[1] where proper care has been taken, the effects are quite over by the following day, the tongue wears its wonted appearance, there is no fever, no abdominal tenderness or pain, and not unusually the secretions of perspiration and urine have been increased. In some cases the oil produces no purgative effect, but, on the other hand, oppression and uneasiness of the epigastrium, general restlessness, violent palpitations of the heart, pains in the limbs, and headache, with confusion of ideas, followed by flushes of heat, perspiration and sleep, and a sense of weariness upon the following day.[2] Bucheim maintains that the acrid principle of croton oil is not the only source of its cathartic action, because even where the oil by thorough washing with alcohol is rendered perfectly mild to the taste, and incapable of pustulating the skin, it is still strongly purgative. This effect he attributes to the reaction which takes place between the oil thus prepared and the alkaline liquids of the duodenum.

In large doses croton oil acts as a violent poison. In a case related by Giacomini, twenty-four grains (?) of the oil mixed with two of castor oil, were swallowed by mistake.[3] The patient survived twenty-four hours, during which period he had but four stools. His features were sunken, the tongue pale and moist, the pulse thready and irregular, and the skin was bathed in a cold sweat, but the mind was clear. The intestines are said to have presented after death no other lesion than a superficial redness. One hundred and fifty grains by weight were taken by mistake in another case, which is quoted by Orfila. The patient was in the fourth week of an attack of typhoid fever. There was a general collapse, such as is observed in malignant cholera, the pupils were motionless and insensible, the abdomen tender, and there were efforts at vomiting. Profuse diarrhœa set in, and the patient died about four hours after having swallowed the oil. No marked change was found in the mucous membrane of the stomach. The absence of local lesions in these two cases proves clearly that the poisonous effects of the oil are not due to its primary action upon the parts to which it is applied. On the other hand, a large dose may not produce serious consequences, as in the following case. A little girl six years of age, took three grammes (about forty-six grains) of croton oil mixed with milk and coffee when the stomach was empty. She experienced some irritation in the fauces at the time, and, soon afterwards, acute pain in the stomach, with violent and profuse vomiting which lasted for three-quarters of an hour. No evil consequences whatever ensued.[4] In the following case the action of the oil was complicated by that of other irritants. It is related by Dr. Adam, of a man who swallowed by mistake a liniment containing about a drachm of croton oil, as much oil of turpentine, and twice as much camphorated oil. He experienced a violent burning sensation from the fauces to the stomach, and a

[1] Lectures, Lancet, July, 1838, p. 573.
[2] PIEDAGNEL, Bull. de Thérap., vii. 102.
[3] Op. cit.
[4] Bull. de Thérap., lxxvi. 43.

convulsive g[illegible]ing, and in about ten minutes was attacked with violent purging and vomiting. Sulphate of zinc was administered, and tickling of the fauces employed to keep up the vomiting, but it was not until these measures had been maintained for an hour that the patient became faint, cold, and pale, and his lips livid, while his pulse was almost imperceptible, and he could no longer maintain a semi-erect posture. These symptoms were relieved by rest and laudanum. At the end of twelve hours, there was tenderness of the epigastrium and along the track of the colon, but it had greatly diminished by the following day. Rawness of the mouth was still felt, and after two or three days its epithelium came away in shreds. Within a week the patient had quite recovered, but felt rather feeble.[1]

Externally, croton oil is a powerful and peculiar irritant. Applied to the eye it excites severe and persistent burning pain, with violent inflammation and redness even of the adjacent skin. Rubbed upon the skin it occasionally demonstrates its absorption by producing diarrhœa. A case is related of two attendants in Guy's Hospital, who were attacked with nausea, an unpleasant taste in the mouth, and diarrhœa after rubbing the abdomen of another person with an embrocation containing croton oil.[2] Piedagnel produced diarrhœa by applying it upon adhesive plaster to the chest and neck of a tuberculous patient.[3] Schneider describes its endermic use as producing alvine evacuations in children.[4] Such effects are very unusual. Andral observed diarrhœa in not more than one out of thirty cases in which he used frictions of this oil upon the skin. The testimony of other observers is nearly the same. The author has been much in the habit of using croton oil to pustulate the skin, but has never met with a case in which it seemed to exert a purgative action. Bucheim introduced nearly five grains of crotonate of potassa under the integument of a cat, and although excessive local inflammation resulted, the bowels of the animal were unaffected. The same dose of the compound having been thrown into the small intestine of a cat, violent bloody diarrhœa speedily came on, and the animal perished. Sometimes when applied by friction to the integument, it fails altogether to produce its characteristic effects. But such examples are rare. In general it brings out, after a few hours, an eruption of minute red pimples, which are always more numerous in proportion to the delicacy and vascularity of the skin, and which gradually are converted into pustules. Some of these have the flattened and umbilicated aspect of the variolous or the tartar emetic eruption, but the greater number are acuminated or rounded. Many of them are apt to be confluent. They are surrounded by a red areola, and accompanied with a more or less severe burning pain and itching.

[1] Edinb. Med. Journ., i. 932. For other cases, vid. Bull. de Thérap., lx. 39; Edinb. Journ., vii. 134; Brit. and For. Med.-Chir. Rev., Oct. 1861, p. 530; Times and Gaz., Dec. 1862, p. 660.

[2] Lond. Med. and Surg. Journ., Dec. 1828.

[3] Loc. sup. cit.

[4] RICHTER, Ausfür. Arzneim., ii. 375.

The eruption augments for three or four days, and then remains stationary. Somewhat later, the pustules break in part, and form scabs, and in part wither away. If they are numerous and large they become confluent, and form thick and extensive crusts. Between the sixth and twelfth days they separate, and leave no cicatrix behind them.[1]

Uses.—In obstinate *constipation* of the bowels and when there exists no contraindication arising from inflammation or structural alteration, croton oil is one of the most appropriate of the purgative class of medicines. It is particularly so when bulky doses are objectionable, and when the patient resists the administration of more ordinary medicines. Of the former description are cases of intestinal obstruction from accumulated fæces produced by simple torpor of the bowels, diseases of the nervous centres, the poison of lead, etc. Of the latter sort are the frequent instances of a refusal to take medicine, among children and insane persons. The oil may in these cases be mixed with milk or soup, and is then generally swallowed unsuspectingly. With the insane, however, the expedient will seldom bear frequent repetition, for they speedily grow suspicious of food which has so unwonted an operation. On account of the smallness of its dose, croton oil has been recommended as a purgative for children whenever they require one of active powers. By carefully proportioning the quantity there need be, it is said, but little fear of its producing injurious effects.[2] But the safer counsel would be to exclude so powerful an agent from the therapeutics of the young, unless in wholly exceptional cases.

This medicine is a very efficient purgative in *lead colic*. It was much recommended by Kinglake, and was used successfully by Andral. The conclusion of the latter was that it is quite equal to the treatment known as that of *La Charité*.[3] Tanquerel des Planches conceived that it cures a larger proportion of cases and with more promptness than the treatment just mentioned, and Grisolle was of the same opinion. The mode in which these physicians administered it was extremely simple, and consisted in giving one drop twice a day at intervals of seven or eight hours. The patients were meanwhile directed to drink freely of barley-water or other similar liquid.

It has sometimes been used successfully to expel the *tapeworm*, and this effect is even said to have been produced by frictions of the abdomen with the oil. Sandras gives an example of its success. Puccinotti one, also, in which it was systematically administered after two or three days of strict dieting. The natives of the East Indies made use of this medicine extensively as a remedy for *dropsy*. It is certainly a powerful hydragogue cathartic, producing large serous evacuations, and at the same time augmenting the secretion of the kidneys and of the skin. Richter used it successfully in some cases of ascites and of anasarca, but advises that

[1] ANDRAL, Archives Gén., xxviii. 275.
[2] CORY, Lond. Med. Gaz., July, 1833. [3] Archives Gén., 2ème sér., ii. 549.

it should not be given to persons of an irritable constitution or liable to inflammatory complications.

Korropleff, a Russian physician, has recommended croton oil as a remedy for *dysentery*. He prescribed a mixture of from one to three drops of the oil in about six fluidounces of mucilage flavored with orange-flower water, of which a tablespoonful was given every half hour. After three or four doses, it is said several copious stools take place, the first mixed with blood, the others not; and if the mixture was continued, it generally sufficed for a cure.[1]

Cerebral affections which call for purgation, such as *apoplexy*, *congestion*, or *dropsy* of the brain, are conveniently treated by this medicine on account of its speedy and searching operation, and the first mentioned disease, particularly, because the oil can be given with more ease than any bulkier agent. From its successful employment in some cases of *epilepsy* it has been supposed by Dr. Newbigging to possess a specific influence over this affection, and Mr. Cochrane, from its effects in several of his own cases, made the same inference.[2] But the conclusion is scarcely an admissible one, for in the cases which seem chiefly to have been benefited by the oil, the alvine discharges gave evidence of great torpor and other derangement of the digestive organs.

Externally, croton oil has sometimes been used with advantage to remove *cerebral symptoms* produced by the suppression of a cutaneous eruption, or by any other cause. Indeed pustulation in this manner is one of the most efficient methods of counter-irritation that can be employed under the circumstances mentioned. It is less severe, and is more under control, than tartar emetic, and is more permanent in its action than cantharides. A case of simple meningitis which illustrates the efficacy of the remedy, has been published by Henriette.[3] As a remedy for spinal *neuralgia* and *sciatica*, Joret gives it a preference over all other counter-irritants. The inhabitants of Molucca used it for the latter affection. It has also been recommended internally by Mr. Hancock[4] for sciatica, upon the ground that the disease is often produced and maintained by hardened fæces in the colon, and especially in its sigmoid flexure. The results of his treatment appear to sustain this view, but at the same time render it probable that any other active cathartic would be equally effective by removing the morbid cause. Croton oil is, however, more convenient on account of the facility of its administration, and its thorough operation. In *chronic rheumatism* croton oil has sometimes been used *externally* with decided advantage, but it is, on the whole, less useful than stimulant embrocations which do not vesicate, and than plasters of cantharides which do. Chronic inflammations of the *laryngeal* or *bronchial* mucous membrane are sometimes greatly mitigated by pustulation of the skin of the throat or chest; for such affections it greatly excels in efficacy the other counter-irritant applications just alluded to.

[1] Archives Gén., 5ème sér., iv. 94.
[2] Edinb. Month. Journ. of Med. Sci., i. 475.
[3] Bull. de Thérap., liv. 46.
[4] Lancet, March, 1854, p. 242 and p. 268; and April, 1855, p. 428.

Administration.—Croton oil may be given in emulsion, or mixed with some other oil, or in pill. Of these forms the last is generally to be preferred. The *dose* is from one-quarter of a drop to two drops. A safe and convenient mode is the following: Add to two drops of croton oil enough alcohol to dissolve them, and then of bread crumb a sufficient quantity. Make from four to eight pills, of which one may be taken every hour or two.

The oil may be applied externally by means of a feather, brush, or other convenient instrument, and friction made with a rag until the skin becomes dry. Or it may be mixed with olive or castor oil, or with soap liniment, alcohol, or ether, and applied as before. Or, again, a piece of adhesive plaster may be moistened with it except at the edges, and then applied to the skin. A mixture of one part of croton oil with seven of oil of turpentine is more rapid in its action than the oil alone.

Antidotes.—Milk, olive oil, mucilages, etc., may be given to dilute and envelop the acrid substance; and, when there is a tendency to collapse, opium and alcoholic drinks, and warm stimulating baths should be employed.

HELLEBORUS.—Black Hellebore.

Description.—This is the root of *Helleborus niger*, a native plant of Auvergne and Burgundy in France, of Switzerland, Austria, and Greece. It was long regarded as identical with the black hellebore of the ancients. The latter has been shown by Tournefort and Sibthorp to have been more probably *H. Officinalis* or *orientalis*, which abounds in Greece. But as black hellebore is also a native of that country, and as the properties of both species are nearly identical, no practical objection exists to including both in the general medicinal history of hellebore.

Black hellebore is a low herbaceous plant, which, between December and February, bears a large white flower, whence in England it receives the popular name of Christmas rose, and in Germany is called *snow rose* (Schnee Rose). The root is composed of a black, contorted, and knotty root-stalk and the fibres or radicles which arise from it. The latter, which are usually recommended for medicinal use, are about the thickness of a straw, of a dark brownish-black color externally, whitish within, spongy, and brittle. When fresh, their taste is said to be extremely acrid; when dry it is less so, but it is rather nauseous and bitter. Bastick obtained from it a peculiar principle which he called *helleborin*. It forms white shining crystals, dissolves with difficulty in water, but readily in ether or alcohol, and has a bitter and acrid taste. It is neutral in its reaction, and combines both with alkalies and acids.

The officinal preparations are:—

Extractum Hellebori.—*Extract of Black Hellebore.*

Twelve troyounces of the root, in coarse powder, are treated by percolation with diluted alcohol; the filtered liquor is then evapo-

rated to a proper consistence. Dose, as a drastic purge, ten or fifteen grains.

TINCTURA HELLEBORI.—*Tincture of Black Hellebore; Tinctura Melampodii.*

Four troyounces of black hellebore, in powder, are treated with diluted alcohol, by percolation, until two pints of filtered liquor are obtained. Dose, from thirty minims to a fluidrachm.

History.—In the writings of Hippocrates this medicine is frequently mentioned, and it is described at length by Pliny.[1] Both distinguish the black and the white hellebores, and state, what modern observation has only confirmed, that the latter acts chiefly upon the nervous system, but the former as an irritant to the gastro-intestinal canal. Both medicines were, however, employed for the same class of diseases, particularly dropsy, paralysis, epilepsy, and insanity. Pliny alludes to the occasional violence of their action. The species which grew in the island of Anticyra was renowned for its efficacy in mental disorders, so that the phrase *navigare Anticyras* was equivalent to saying that one had become insane. He states that Anticyra produced a sort of sesame (*reseda undata*, L.), which greatly modifies the action of the hellebore. The completest account of the subject is given by Dioscorides,[2] who clearly contrasts white hellebore (veratrum album) and black, for he attributes to the former emetic and to the latter purgative qualities, a distinction which had, indeed, already been made by Hippocrates. Black hellebore, it is generally supposed, was called *Melampodion*, from Melampus, who is said to have cured the daughters of Prætis of insanity by purging them with this plant. Such is the statement of Dioscorides; but Galen, and with him the greater number of medical historians, expressly name white hellebore as the medicine which cured the king's daughters. Dioscorides states distinctly that the black was the species produced in Anticyra. He attributes to it emmenagogue properties in addition to those enumerated by Pliny, and adds that it is apt to destroy the fœtus in utero. Both of these writers, as well as Galen, recommend it for cutaneous eruptions, and as a maturative for the cure of fistulous sores. The Arabian physicians add but little to the above account, but, while dwelling on the valuable cathartic properties of the medicine, insist upon its being dangerous to life, unless duly guarded by diluents, and the preparation of the system for its use by abstinence.[3]

Action. *On Animals.*—The ancients had already remarked that hellebore is poisonous to birds and several other animals, but modern experimenters have demonstrated the peculiarities of its action upon quadrupeds, reptiles, insects, etc. They are sufficiently illustrated by its effects upon dogs, horses, cats, etc., as shown in the experiments of Schabel and Orfila.[4] When its powder is ap-

[1] Hist. Nat., xxv. 21.
[2] Lib. iv. cap. 145 and 146.
[3] EBN BAITHAR.
[4] Toxicologie, ii. 454.

to the cellular tissue, it speedily gives evidence, by vomiting, ity, insensibility, etc., of having been absorbed, and at the time excites some degree of local inflammation. Its constitu- l effect upon the higher animals, particularly when given in- lly, may be thus described. Soon after its administration the hing grows laborious and slow, the pulse slackens, and in a minutes a disposition to vomit is apparent, mucus and bile are wn up, saliva is copiously discharged, and there are signs of minal pain. The animal moves with a tottering and feeble has muscular tremors of the hinder and then of the anterior mities, pants in breathing, and lies powerless upon the ground. his stage the efforts at vomiting cease; convulsions set in, and time to time increase, and the animal perishes in tetanic ns. After death the gall-bladder and ducts are found dis- ed with bile, and a large quantity of this fluid is contained in mall intestines. The liver is often congested; the gastric mu- membrane, that of the small intestine, and, if the animal has survived, of the rectum also, is inflamed.

Man.—It is said that hellebore-flowers, when crushed and ied to the skin, produce redness, and even vesication: but that ier the root nor the leaves have such an effect.[1] In small doses bore appears to stimulate the abdominal organs, augmenting secretions of the liver and pancreas, quickening the peristaltic ements of the bowels, and augmenting catamenial and hæmor- lal discharges. The symptoms produced by an overdose are following: The digestive organs denote the operation of an l irritant, by vomiting, colic, purging, thirst, spasm of the at, and a burning sensation in this passage and in the stomach. derangement of the nervous and circulatory systems is shown onvulsions, muscular spasms, anxiety, exhaustion, fainting, ium, sunken features, a small, feeble pulse, cold sweats, cold- of the extremities, and death by collapse. After this event whole intestinal canal is found to be more or less inflamed, rding to the time which has elapsed since the ingestion of the on. A case was reported by Mr. Massey, of Nottingham, and, in which a strong infusion of black hellebore was taken, istake for infusion of gentian. Besides the symptoms just ribed, except the last (for the patient recovered), a painful prick- n the tongue and fauces was experienced, the tongue swelled, much viscid mucus was voided from the mouth.[2] It will be rved that nothing is said in these reports of a drastic cathartic on. They correspond with the observations of Schroff.[3]

ses.—This medicine was once famous for its use in the treat- t of *insanity*, both of the maniacal and the melancholic forms. latter would seem to have been very decidedly benefited by it, in proportion to the dependence of the disease upon hepatic or stinal disorders. In modern times this practice has not been

DUBOIS, Mat. Méd. Indigéne, p. 367. [2] Lancet, July, 1856, p. 100.
Helleborus und Veratrum, Prager Vierteljahrs., lxii. and lxiii.

generally imitated, yet cases are not wanting in which the medicine seems to have been prescribed with advantage. They were, however, examples of active acute insanity, and some of them, perhaps, of meningeal inflammation, but certainly of febrile delirium. Such cases were reported by Kerr,[1] Gozzi, Roques, Miquel, and others.[2]

The *emmenagogue* properties of black hellebore, which are very decided, were familiar to the ancients. Among modern physicians, Mead recommended it most highly, saying that he "found in it so singular a virtue that it hardly ever failed in answering his expectations." In proof of its efficacy, this writer alleges that when it failed to restore the catamenia, it produced some other discharge of blood.[3] In suppression of the menses from external causes, and particularly from cold, it is probable that this medicine, like emmenagogues of the cathartic class, is chiefly serviceable. In such cases we have used it successfully.

Black hellebore has been much recommended as a purgative in *dropsy;* and doubtless, like other drastic cathartics, it is capable of causing the evacuation of serous effusions. But it exerts no specific control over even this common symptom of various pathological conditions, and, on account of its harsh operation, is less eligible than other medicines of the cathartic class, and particularly jalap. It is also thought to possess *anthelmintic* properties.

Administration.—The dose of the powdered *root*, as a purgative, is from five to twenty grains. A *decoction* may be prepared by boiling sixty grains in a pint of water; a fluidounce of it may be given every two or three hours until it operates. Of the *extract* the dose is from ten to fifteen grains. The *tincture* is prescribed in doses of from thirty to sixty minims.

ELATERIUM.—ELATERIUM.

Description.—Elaterium is a substance deposited by the juice of the fruit of Momordica Elaterium, Ecbalium agreste (*Richard*). This plant is a trailing vine, which grows in Greece and the southern parts of Europe, but is cultivated in more northern countries. Its fruit is a small oblong melon, about one and a half inches long, of a grayish color, and beset with soft prickles. Internally, it is filled with a succulent tissue containing numerous black seeds, which, when the fruit is ripe, are forcibly expelled where the peduncle is attached to the fruit. From this circumstance it derives the popular name of *squirting cucumber*, and the specific title Ecbalium (ἐκβάλλω, detrudo). The expressed juice is allowed to stand until a sediment is formed, which is carefully dried upon a filter and upon porous bricks. This constitutes the elaterium of commerce. It occurs in fragments of a layer about one line in thickness, of a pale greenish

[1] Medical Sketches. [2] DUBOIS, op. cit., p. 330.
[3] Works, p. 429.

or grayish color, an animal odor, and an acrid and bitter taste. It forms a greenish tincture by digestion with alcohol. Its active properties are due to *elaterin*, which exists in elaterium in proportions varying with the purity of the latter. It is white, crystalline, very bitter, but without smell, has a neutral reaction, and dissolves in hot alcohol, but not in water.

History.—According to Fœsius, elaterium was so commonly used as a purge by the ancients, that the term came to be applied to purgatives in general. Yet in the Hippocratic writings (ed. Littré) it is but twice mentioned as a purge, and without special emphasis. It is however stated that the milk of a nursing woman who has taken elaterium becomes purgative to her infant. The wild gourds which rendered the pottage poisonous, and whose effects the prophet Elisha prevented by adding meal to the mess, are held to have been elaterium fruits.[1] Pliny refers chiefly to the external uses of the root, but he, and Dioscorides more particularly, describe minutely the manner of procuring elaterium from the fruit. It is identical with that which is generally supposed to have originated with Dr. Clutterbuck. Dioscorides states that the expressed juice of the root and of the bark is a sovereign cure for dropsy, and the juice of the fruit a valuable cholagogue, but he cautions against the danger of super-purgation by its use.[2] The Arabians were well acquainted with the operation of elaterium. It was highly prized by Sydenham, but seems not to have been generally used until, since the commencement of the present century, it was eulogized by Ferriar as a hydragogue remedy for dropsy, and the proper mode of preparing it was revived by Dr. Clutterbuck.

Action. *On Animals.*—Viborg found that a horse was unaffected by a pound of elaterium fruit, and by two and a half pounds of the root, stalk, and leaves of the plant.[3] The experiments performed on dogs and rabbits have not furnished uniform results. In some cases death has occurred without being preceded by any evacuation whatever, the animal appearing to be suffering severe pain in some instances, and in all to perish by progressive depression. In other instances, and probably when the dose was larger, violent purging and vomiting, or efforts at vomiting, preceded death. In all cases, after death, signs of congestion and inflammation were found in the stomach and intestine. When a solution of elaterium is injected into the cellular tissue of an animal's thigh, death may take place by nervous depression, without any evacuation, and, on examination, the limb will be found highly inflamed. The only trace of intestinal inflammation in such cases consists of some redness in the rectum.[4] More recent experiments, and particularly those of Köhler,[5] show that in rabbits and in dogs, however this substance may

[1] STRUMPF, op. cit., ii. 210.
[2] Lib. iv. cap. cxlix.
[3] WIBMER, op. cit., iii. 296.
[4] MORRIES, Edinb. Med. and Surg. Journ., xxxv. 339; ORFILA, Toxicologie, 5ème éd., ii. 100.
[5] VIRCHOW'S Archiv, i. 380.

be introduced into the system, it does not occasion either vomiting or purging. These animals die, rather, with tetanoid phenomena.

On Man.—Sigmoid states that both purging and severe inflammation of the hands and arms have occurred from the contact of the elaterium plant with the skin, and that some persons in the employ of the London Society of Apothecaries were severe sufferers from their not being aware of this circumstance.[1] Richard relates that a physician, having carried some specimens of the flowers in his hat, was attacked within half an hour with very severe constrictive pain in the forehead and temples, colic and epigastric distress followed by repeated thin and liquid stools, and obstinate vomiting of a bilious and greenish liquid. These symptoms continued for more than twelve hours.[2]

Morries gave to a person in perfect health a twentieth of a grain of elaterin, which at the end of two hours produced vomiting and copious dejections. Dr. Christison administered it in four cases, in doses of a tenth of a grain. In two of them vomiting and purging were produced, in a third griping, and in a fourth no effect. This experiment illustrates the uncertain action of the same preparation due to differences in the susceptibility of individuals. Other cases might be cited to show that the medicine varies greatly in its effects according to the strength of the preparation employed, and according to its administration in a liquid or solid form. In the following example it is probable that a comparatively feeble specimen of elaterin was made use of. Schroff administered to each of two physicians one grain of crystalline elaterin. It crackled under the teeth like fine sand, had a bitter taste, dissolved very slowly in the saliva, and excited a profuse secretion of this fluid. One of the experimenters became nauseated in about three-quarters of an hour, and vomited a mucous liquid. During the following two hours vomiting of bile recurred four times, and each time the salivation increased, with eructations of wind, rawness in the throat, and flatulent colic. When the experimenter became warm in bed these symptoms subsided, but some abdominal pain continued, the head also continued dull and painful, and at the end of eight hours a copious evacuation from the bowels took place of a liquid which was brownish at first but afterwards colorless. An hour later a second, and several hours afterwards, a third liquid evacuation took place. The headache, meanwhile, was aggravated. After the discharges the abdomen was retracted and felt painfully empty, and there was complete anorexia. In the second case the phenomena were essentially the same, but the discharges were larger and more numerous, and continued until the third day. The subsequent exhaustion was also more complete.[3]

We are not acquainted with any case of death produced by elaterium or its active principle. One, indeed, is reported[4] of a woman who died from purging produced by two and a half grains of "the

[1] Lancet, Aug. 1838, p. 680.
[2] Ann. d'Hygiène, viii. 333.
[3] Lehrbuch der Pharm., p. 353.
[4] BECK, Med. Jur., 10th ed., ii. 677.

extract" and sixteen grains of rhubarb. But neither is the previous condition of the woman mentioned, nor is allowance made for the share of the rhubard in the result.

Uses.—Elaterium may be used with profit in a great many cases requiring derivation from the head and the evacuation of dropsical effusions. When there is a plethoric condition attended with indications of *cerebral* or *pulmonary oppression*, elaterium affords a means of prompt and marked relief, much more so than various other single purgatives or purgative combinations, which are less disagreeable in their operation and also less apt to depress the system. If these grounds of objection do not exist, no evacuant medicine is comparable with this one for the thoroughness of its therapeutic operation.

But it is in *dropsy* that elaterium has been chiefly and most advantageously used. We need hardly here repeat the remark made elsewhere, that the curability of dropsy depends upon the possibility of removing its cause. There are many cases in which the effusion results from a temporary suspension of the balance between exhalation and absorption, and in which the removal of the fluid constitutes the cure of the disease; and there are many others in which the organic lesion which was the primary cause of the dropsy is in its nature incurable, and therefore the evacuation of the dropsical liquid, by whatever means, can only be regarded as a palliative remedy. Undoubtedly there are, also, cases in which the extent of organic lesion and its degree of influence are uncertain, and in which a merely evacuant treatment is followed by a complete cure of the dropsy. Hence there is one class of cases in which elaterium may rationally be expected to be curative, and another in which it offers as many grounds of hope as any other remedy of its class.

Sydenham speaks of two medicines which, he says, "bear the bell from all that I have named or know—I mean elaterium and the *crocus metallorum*. Elaterium, or the fecula of the wild cucumber, acts in very small doses, and acts powerfully," etc.[1] Ferriar declares that "its powers in removing serous accumulations surpass those of any other medicine,"[2] while he admits that in certain cases the eventual termination of the organic disease causing the dropsy is thereby only postponed. This writer makes the important remark that after continuing the use of the medicine for several days, the patient will sometimes bear a considerable increase of the dose, so that after beginning with the sixteenth part of a grain of the extract, it may be gradually increased to the extent of five or six grains a day without producing any inconvenience. It is unnecessary to multiply citations in evidence of the anti-hydropic virtues of a medicine whose use has now become so general; suffice it to say that, as a simple hydragogue cathartic, it is incomparably the most certain in its curative effects. Its advantages are peculiarly manifest in the treatment of *ascites*. In other forms of dropsy,

[1] Works (Syd. Soc. ed.), ii. 169. [2] Med. Hist., etc., iv. 21.

diuretics, saline and vegetable, and especially digitalis, possess superior advantages; but in cases of abdominal dropsy which resist these remedies, as too many will do, a more certain resource is offered by elaterium.

Administration.—The variable strength of elaterium renders it proper to exhibit a minimum dose of it in the first instance. This may be stated at about one-sixteenth of a grain. It may then be rapidly increased until its appropriate operation is established. Elaterin may also be administered in the dose of about one-sixteenth of a grain. If pure, the dose of it should be very cautiously augmented. Either form of the medicine may be prescribed in pill made with conserve of roses and extract of hyoscyamus. Elaterin is most efficacious in solution, as in the formula of Golding Bird: ℞.—Elaterinæ, gr. iv; alcohol, f℥iv; dissolve by a gentle heat. Half a fluidrachm contains one-sixteenth of a grain of elaterin.

PODOPHYLLUM.—May-Apple.

Description.—*Podophyllum peltatum*, the rhizome of which forms the officinal portion of the plant, is a native of the United States. It is perennial, and flourishes most in damp and shady woods, but occasionally is found in dry and exposed situations. The root is long, creeping, brown externally and white within; the leaves, of which there are only two, are large, deeply lobed, and incised, of a yellowish-green above and lighter below; the flower is placed in the fork of the leaves, and is large, white, somewhat fragrant, and has a recurved peduncle; the fruit is an oval berry about an inch and a half in diameter, of a lemon color, and containing a thick pulp of a sweetish, but rather nauseous flavor. The rhizome, as found in commerce, is in slender brownish pieces, several inches long, jointed, wrinkled, and bearing the remains of the radicles. Its fracture is short and the exposed surface white. The powdered root is grayish. It has a slightly sweetish odor and a bitter, acrid, and nauseous taste. It imparts all its virtues to alcohol, but in part only to water. They depend chiefly upon a resin which is officinally prepared as follows:—

Resina Podophylli.—*Resin of May-Apple. Podophyllin.*

The powdered rhizome of May-apple is deprived, by percolation with alcohol, of its resin, which after reducing the alcohol by distillation to half a pint, is precipitated by water acidulated with muriatic acid, and dried. It is of a color varying from drab to bright yellow. Dose, one-sixth to one-fourth of a grain as a laxative; one grain as a purgative.

Extractum Podophylli.—*Extract of May-Apple.*

It is prepared by exhausting powdered May-apple with alcohol, and evaporating the tincture to the proper consistence. Dose, from five to fifteen grains.

History.—It is stated, upon the authority of the Rev. F. Heckewelder, that the American aborigines had been known to use the young shoots of this plant to destroy themselves.[1] Long before its adoption as a medicine by physicians, the root was popularly employed as a purgative.

Action. *On Animals.*—In the inaugural thesis of Dr. F. H. Snow, quoted by Dr. J. R. Coxe, it is stated that after a decoction of the leaves was administered to a dog, the animal's pulse became weak, copious salivation ensued, and incessant vomiting until death, which resulted within twenty-four hours. Dr. S. R. Percy gave two grains of commercial podophyllin to a dog. Within eight hours it had produced three free alvine evacuations. The same dose was repeated the next day, and it acted on the bowels in three hours, causing, during the day, more than a dozen evacuations. To the same dog one grain of podophyllin dissolved in liquor potassæ was administered by hypodermic injection. It produced great local irritation, free purging in two hours and twenty minutes, evident colicky pains, and much tenesmus, with retching, but no vomiting.[2] A series of experiments on dogs, cats, and rats performed by Dr. F. E. Anstie throws a clear light upon the operation of this medicine.[3] He made use of an alcoholic solution of podophyllin by injecting it into the cavity of the peritoneum. No inflammation of this membrane was excited, and for the intoxicating effects of the alcohol allowance was duly made. As the results were very uniform, a detailed account of one experiment will suffice. Half a fluidrachm of the solution, containing two grains of podophyllin, were thrown into the peritoneal cavity of a full-grown dog. "The animal was not at all discomposed by the operation, and a few minutes after was eating food. Until ten hours afterwards the dog was perfectly lively, and showed no signs of uneasiness. He now commenced retching violently, and brought up only a little mucus. This symptom continued, and was soon accompanied by purging; the stools consisted of glairy mucus; and, after a time, were mixed with blood; the animal whined constantly, and seemed in pain; it also drank water eagerly. Four hours from the commencement of the symptoms, the breathing was shallow and hurried, and the pulse rapid and feeble. At the end of four hours later it was found lying on its side, totally insensible, with glazy eyes, the heart's action very slow and weak; respiration consisting of from four to six convulsive gasps per minute. In this state it lay with little change for the next eight hours. At the end of this time a slight general convulsion occurred, and breathing ceased about two minutes and a half later. The thorax was quickly opened, and the heart was found still beating; it continued to pulsate for five minutes, and its irritability persisted for some time after this. On post-mortem inspection, there was no fluid of any kind in the peritoneal cavity, and the membrane was quite smooth,

[1] EBERLE's Therapeutics. [2] Am. Med. Times, iv. 243.
[3] Times and Gaz., March, 1863, p. 326.

polished, and transparent. The kidneys were rather congested, and the liver moderately so; the gall-bladder contained very little bile. The pharynx, œsophagus, and stomach were healthy, except that the stomach contained some bloody fluid evidently brought into it from the intestine by repeated retching. The mucous membrane of the whole small intestine was intensely inflamed, especially that of the duodenum; in the latter situation were nine ulcers, rather less in size than a threepenny piece, and there was one smaller ulcer near the lower end of the ileum. The mucous membrane of the whole small intestine was covered with tenacious bloody mucus. The inflammation ceased abruptly at the ileo-cæcal valve; the large intestine was healthy; nowhere was any bile observed in the bowels. The mucous membrane of the bladder was slightly congested."

From the whole of his experiments Dr. Anstie drew several conclusions, of which the following may particularly be cited: "Podophyllin exercises a special influence of an irritant kind upon the mucous membrane of the intestine, and usually of the small intestine only. As a secondary result of this irritation, or perhaps as a mere consequence of the squeezing of the gall-bladder by the abdominal muscles in repeated efforts at defecation, bile is occasionally poured out in large quantities. In no case is an inflammatory process excited in the liver. For these reasons it is pretty certain that, in the animals above mentioned, podophyllin does not act directly upon the liver, and that it produces catharsis by its specific irritation of the intestinal mucous membrane." The committee of the British Medical Association appointed to investigate the action of podophyllin on the liver, reported that doses varying from two to eight grains, when given to dogs, *diminished* the solid constituents of the bile whether they produced purgation or not; and that doses which produced purgation *lessened* both the fluid and the solid constituents.[1]

On Man.—The description given by Dr. Bigelow forty years ago of the action of podophyllum may be received as accurate at the present day. He stated that it resembled jalap in its operation, but is somewhat slower, and continues its effects for a longer time; in irritable stomachs it occasions some nausea. The slow and disagreeable operation of podophyllin is well illustrated by Pietro's experiment on himself. After taking, one morning, a dose of ten grains, he was seized with nausea and efforts at vomiting which lasted for two hours. At the end of four hours he felt chilly and exhausted, and was obliged to lie down; and it was not until the following morning that the purgative action of the drug began. It was preceded by severe colic, and produced no less than nine soft stools in the course of the day.[2] In small doses it proves a gradual and easy laxative: in large ones a powerful and long-continued purge. A similar account was given by Dr. Burgon,[3] and

[1] Practitioner, ii. 356. [2] Bull. de Thérap., lxxvi. 325.
[3] Am. Med. Recorder, 1820, iii. 331.

by Dr. McBride, of South Carolina.[1] Dr. Percy calls attention to its bitter and nauseous taste and the increased secretion of a saliva which results from this quality, and to the renewal of the flow under the influence of the uneasy and nauseating sensations subsequently felt in the stomach, and which may last for an hour. According to this physician, "Soon the influence is felt in the small intestines, and unmistakable sensations of the secretion of bile are experienced." What the nature of the sensation is that reveals so important an operation is not described; but, whatever it may be, we should regard it as less indicative than the "bilious looking" evacuations which are said to follow, of an increased discharge of bile into the intestine. The cholagogue action of podophyllum is, however, maintained by numerous writers. Thus Dr. Gardner knows "no other substance which so certainly produces bilious evacuations, when the liver is full of bile," and according to Dr. Ward, "it never fails in its cholagogue action," and Dr. Ramskill is "almost tempted to say that there is no real cholagogue known in medicine except podophyllin."[2] Admitting the facts to be as they are stated, they do not imply that the medicine exerts a direct action upon the liver, any more than the salivation excited by its acrid taste proves its specific operation upon the salivary glands. It is the physiological function of the liver to secrete bile more freely when the duodenum is irritated, and particularly when the irritation is of that degree and kind which occasions a copious exhalation of serum and mucus from the lining membrane of the upper part of the small intestine. The conclusion of Dr. Garrod, that resin of podophyllum "often produces actions from the bowels containing abundance of biliary matter, but this is probably more from its causing an emptying of the gall-bladder than from its augmenting the secretion of this fluid," is certainly more correct than the hypothesis which attributes a true cholagogue property to podophyllum. But since the increased discharge of bile may occur without any mechanical compression of the gall-bladder through the act of retching or vomiting, we are disposed to attribute that discharge in part at least to an irritation of the duodenum.

The increased flow of saliva excited by podophyllum has been referred to already. Dr. Gardner met with "two or three cases where it unequivocally produced ptyalism." But Dr. Percy has shown that this effect of the medicine depends upon its nauseant or emetic action, and ceases simultaneously with that action; or else that where this operation does not take place, although the secretion of saliva is augmented, the latter is owing to the direct irritation of the mouth and fauces by the medicine. When it is administered in capsules or in gelatinized pills, no such effect is observed, unless the stomach is irritated to nausea by an excessive dose.

[1] Trans. Am. Med. Assoc., ii. 688. [2] Lancet, March, 1862, p. 286.

Dr. Percy has shown that the resin, when applied to an ulcer, produces its characteristic purgative effects, together with nausea. He also states that the workmen employed to powder it find it excessively irritating to the eyes, nose, mouth, respiratory organs, and even to the skin, and are frequently sick for several days after performing this work.

The exaggerated and even absurd estimate of the virtues of podophyllum by a class of ignorant persons engaged in the treatment of the sick, has imposed upon the judgment of not a few physicians, and led them to attribute qualities to the medicine which experience has not proved it to possess. Nothing has been added to the original judgment expressed by Dr. Bigelow, and which has already been quoted (to wit, that podophyllum is identical with jalap in its operation), unless we accept as demonstrated the cholagogue virtues which are commonly attributed to the former. In all probability the difference depends less upon an intrinsic diversity in the mode of action of the two purgatives, than upon the more active irritant and nauseating operation of podophyllum and its concentration upon the upper portion of the small intestine.

Uses.—Like certain other purgatives, podophyllum is reputed to be very efficient in habitual *constipation* from simple torpor of the bowels, chiefly because it is less disposed than some other cathartics to leave the bowels more torpid than before they were evacuated. Whether this advantage is not too dearly purchased by the nauseating and depressed operation of the medicine in purgative doses appears not to have been sufficiently considered. When, however, small doses are administered regularly, as one-sixth of a grain with an equal quantity of extract of belladonna, or with one grain of extract of hyoscyamus, and a grain of soap, in pilular form, they will be found convenient as a substitute for the other pills in common use for the relief of torpid bowels. As regards the *constipation of phthisis*, which, according to Dr. Gardiner,[1] proceeds most frequently from fatty liver, podophyllin has been given by him "in all stages of the disease with marked benefit;" and Dr. Ramskill asserts that in incipient cases of phthisis commencing with or preceded by stomach and liver dyspepsia podophyllin will be found more valuable than all the drugs of the pharmacopœia.[2] It is equally fallacious in theory and false in fact that dyspepsia, in any sense, is an essential or even a frequent antecedent or attendant of the development of pulmonary consumption, and least of all that form of dyspepsia in which the bowels are confined. During the progress of the disease we apprehend that if there is any one apparatus which the prudent physician will protect from harm, it is that of digestion, because through it alone can reparative materials be introduced into the body. He will not, therefore, torment it with drastic purgatives. Knowing, moreover, the liability of the bowels to tubercular disease, and the dangerous exhaustion which diarrhœa may occasion, he learns to regard irritable bowels as an unhappy sign in phthisis,

[1] Lancet, March, 1862, p. 287. [2] Ibid., p. 418.

and constipation as an ailment to be very tenderly interfered with, if treated by medicine at all. We protest most earnestly against employing an agent in this disease which may be useless, and may be fatally injurious.

Podophyllin has been much used and highly recommended in several affections of the *liver* in which there is a deficient secretion of bile. We read of cases of *jaundice* where "the stools exhibited no trace of bile, and the skin and eyes were of a deep yellow, cured by a single dose, incredible quantities of bile being evacuated." Such effects are of common occurrence after the administration of jalap, scammony, aloes, and colocynth, particularly if it have been preceded by one or more small doses of mercury. No doubt podophyllin will be quite as efficient as either of these medicines. Of course, the only form of jaundice which can be removed by such treatment is one independent of structural lesions, and dependent chiefly upon a defective *excretion* of bile. This affection is the same in origin as the so-called *torpid liver* for which podophyllin is also recommended as a sovereign and specific remedy. When this affection is developed by imprudent habits of living, especially in a hot climate, that is to say, when rich animal food and alcoholic drinks are indulged in and exercise is neglected, a purgative treatment, it has already been repeated again and again, is essential to the cure. It cannot be doubted that of the medicines suitable for this purpose, none excels podophyllin, when it is administered to those who are capable of bearing its somewhat rude and exhausting operation. But in persons of less endurance, milder measures, and especially saline mineral waters, preceded by mercurials, are more appropriate and adequate to the cure. We would not, however, too greatly restrict the use of this or of other drastic cathartics to robust patients only; in not a few cases the strength improves under increased evacuations; and as the flow of the hepatic secretion becomes free, or, in cases of *ascites*, as the effusion subsides, the whole condition of the patient improves. It is not possible that podophyllin can cure cirrhosis of the liver, nor chronic hepatitis, as some have asserted that it can, but in the early stage of either affection it may for a brief period force a discharge of bile and to that extent mitigate the disease. Podophyllin has been proposed by Van den Corput as a remedy for constipation produced by *lead*, according to the following formula: ℞.—Podophyllin, gr. vj; ext. nucis vom. gr. x; ext. belladonnæ, gr. vj, divided into ten pills, of which two or three should be taken daily. On the whole, we cannot but regard podophyllum as an available member of the materia medica, and as worthy to stand on the same line with other drastic purgatives, in spite of its tendency to nauseate, the slowness and uncertainty of its operation, and the prostration which it occasions, and which it displays in a greater degree than its associated medicines, only because it is more energetic than they.

Administration.—The average *dose* of powdered podophyllum may be stated at *ten grains*, but *twenty* may be given as an active purge; the dose of the extract is about the same. The dose of

podophyllin varies a good deal with the variable strength of the preparation, viz., from *one-sixth of a grain* to *three grains*. *Half a grain* may be stated as the average dose. *One-quarter of a grain* will generally act, but not for twelve or more hours. Podophyllin should generally be associated in prescription with extract of hyoscyamus or of belladonna, in order to mitigate its irritant operation. Dr. Percy has proposed to administer the medicine in gelatine capsules covered with mastich varnish. The latter, it is presumed, will not dissolve until it reaches the alkaline secretions contained in the duodenum, and thus the irritating action of the medicine upon the stomach may be avoided.

OLEUM TEREBINTHINÆ. Vid. *Stimulants*.
HYDRARGYRUM. " *Alteratives*.

EXPECTORANTS.

EXPECTORANTS are medicines which are intended directly to modify the character of the bronchial secretions, and promote their discharge.

Evacuant remedies of all the other classes, except anthelmintics, are used not only to act upon the organs to which they are especially addressed, but also through these to influence other organs neighboring or remote, and to remove or palliate the disorders which exist in them. But expectorants, as their name implies, are addressed to the lungs alone, and even to a single element of the pulmonary apparatus, the mucous membrane of the bronchial tubes. Their application is even more limited still; for it is not every condition of the membrane which these medicines are adapted to cure. They are addressed almost exclusively to that one in which the bronchial secretion is excessive and morbid.

Every mucous membrane, like every other secreting surface, when it is attacked with inflammation, undergoes certain definite changes, which succeed one another in regular order, each one being the proper consequence of that which preceded it. In the first stage, the part becomes a seat of vascular congestion which either momentarily augments its secretion, or immediately diminishes it, so that directly, or after a brief interval, it becomes swollen, and the surface of the membrane ceases to be bathed in the secretion which is intended to protect and render it pliant. The natural solution of this morbid state is the discharge of more or less fluid, consisting of the natural secretion of the part mingled with the products of the inflammatory process.

In the case of the pulmonary mucous membrane, this termination is speedily brought about by the unaided powers of nature, when the inflammation is slight and superficial, and external causes

tending to aggravate it are carefully withdrawn. Or it may be induced artificially by the administration of medicines of the purely stimulant class, which, by exciting the whole vascular system, including that which is especially affected, forcibly overcome the stagnation of the blood in the vessels of the bronchial mucous membrane, and prevent the ulterior changes which it there tends to produce. This action is illustrated by the familiar method of administering a diffusible stimulant, such as a hot alcoholic drink, or a hot infusion of some stimulant herb, at the commencement of an attack of pulmonary catarrh, with or without the addition of an opiate, and a revulsive agent in the shape of a warm stimulating foot-bath. Thus derivation and general stimulation combine to relieve the lungs of a congestion which, were it allowed to continue and increase, might involve a prolonged and possibly a serious inflammation.

If the natural powers or the employment of such remedies produce their proper effect, there may be no increased bronchial secretion accompanying the resolution of the attack. But if they have not been used, or have proved inadequate to the removal of the bronchial congestion, an inflammatory state results, the bloodvessels are overstrained, and permanently enlarged and weakened, and the interstitial tissue becomes the seat of a sero-albuminous effusion, and more or less fever and local distress occur. The subsidence and removal of these symptoms can only be accomplished by the removal of their physical cause, the combined congestion and effusion which have been referred to. As the morbid elements involved are those of simple inflammation, so their cure is, in the first place, to be intrusted to antiphlogistic remedies, strictly so called, such as depletion, cathartics, and arterial sedatives, and afterwards to diluents and lenitives. The former remove the tension of the bloodvessels, and permit their contraction, and consequently, the resumption of their functions, one of which will then be manifested by the occurrence of a greater or less degree of secretion into the bronchial tubes, which tends still more to diminish the vascular infarction. The latter furnish a larger quantity of aqueous fluid to the blood, and probably, also, other principles which further modify the quality of this liquid, and render its secretions less acrimonious. Such remedies, then, promote the secretion of the bronchia as they do that of all the other organs at the same time. They have no specific direction to the lungs, nor do they tend to modify the condition of the lining membrane of these organs, nor the amount or kind of its secretion more than they do that of any other mucous membrane similarly inflamed, with which they are not brought directly into contact. They may promote expectoration by their influence upon the qualities, and especially upon the tenaciousness of the bronchial mucus, but as they do not exert this influence upon the mucous membrane of the lungs more than upon other tissues in other parts of the body which happen to be affected in the same manner, they have no peculiar claim to the title of expectorants.

Again, there are certain medicines upon which it would be equally improper to confer the title of expectorants, although they promote expectoration in a more literal sense than those just referred to. Such are sternutatories, which, by exciting the act of sneezing, assist in discharging the contents of the air-passages. Their action is quite mechanical, and that of emetics differs from it in nothing except that some among them, of the nauseant division, promote at the same time the bronchial in common with all the other secretions of the body. A similar observation is applicable to general stimulants, which, although in states of great physical depression they render expectoration possible, and often become thereby the means of saving life, yet exert no more direct influence upon the lungs than upon any other part of the economy.

True expectorants are those which appear to have an especial direction towards the bronchial mucous membrane alone, or towards it in common with the mucous membrane of other organs. They are all stimulants, and the greater number of them contain a resinous element more or less modified by its association with other principles. With such qualities, and such a tendency to the seat of bronchial inflammation, it is evident that if they are administered during the active stage of such inflammation, they must almost of necessity aggravate it, by arresting that process of restoration of which the inflammatory symptoms are the signs, and which, it has before been intimated, is to be palliated by remedies which diminish the vascular engorgement of the affected membrane. If these measures are duly applied in regard to time and degree, and if the patient be of good constitution, they will suffice for his perfect cure; but if, as so constantly happens, the original bronchitis is neglected, or not efficiently treated by the proper remedies, it merges gradually into a chronic form which can only be aggravated by the antiphlogistic measures which at first were appropriate. As in chronic inflammation of other mucous membranes, the blood-vessels remain enlarged, the membrane itself becomes thicker than in health, and from its surface mucus is secreted of various degrees of consistence and shades of color, more or less mixed with a serous liquid, and ultimately containing more or less pus. Under these circumstances, as in similar conditions of the mucous membrane of the eye, the nasal passages, the fauces, urethra, and vagina, a stimulant treatment is found to be the most successful. It may consist of stimulant vapors directly applied to the diseased surfaces by inhalation, or of stimulant medicines of the class of true expectorants.

As it has been stated in the introduction to this work, the inhalation of medicinal vapors for the cure of bronchial disease is a remedy of ancient date, and their efficacy renders it more than probable that when the same medicines are administered internally they are absorbed, and have a peculiar tendency to be eliminated by the air-passages. That this is the case with some among them, as the terebinthinates, garlic, and assafetida, there can be no doubt; and the striking effects of the others render it probable that they also are discharged in part by the bronchial mucous membrane,

and, during their passage, modify its secretion by a stimulant action upon the nerves and bloodvessels concerned in elaborating it.

Now, between the mildest degree of chronic bronchitis which tends to a spontaneous cure, and the gravest accompanied with dilatation of the bronchia and a profuse purulent secretion, every degree of inflammation may exist, and demand, therefore, various degrees of expectorant stimulation. In cases which have the character of a subacute bronchitis unduly prolonged, the milder articles, such as garlic, seneka, and squill, will be found appropriate. If the secretion is dense and tough, muriate of ammonia and ipecacuanha are to be preferred; and if, on the contrary, it is profuse and more or less purulent, sulphur, ammoniac, benzoin, tar, and, above all, copaiba, should be employed. If the cough is paroxysmal and spasmodic, garlic or ammoniac, but more particularly assafetida, will be most suitable; and if the secretion is very abundant, but not purulent, seneka or squill, in conjunction with sulphate of zinc, is a useful combination. But in all cases of the last description there is reason to suspect the existence of a mechanical obstacle to the circulation through the lungs or the heart, and an attempt to arrest the pulmonary secretion might therefore be attended with serious consequences. On the other hand, when the cough is dry and harassing, the administration of nauseants, sedatives, or even of muriate of ammonia, whose direct influence on the promotion of the bronchial secretion is very decided, ought to be entered upon cautiously, and only after a thorough examination of the lungs has rendered it probable that the cough is not excited by degenerative tissue changes.

SENEGA.—SENEKA.

Description.—The root of *Polygala Senega* or *Seneka snakeroot*, a plant which grows wild in the United States throughout its southern and western parts. Its stalk, which is from nine to twelve inches high, is purplish below but green near the top. The leaves are alternate, sessile, pointed, and paler beneath. The flowers are small and white, and form a spike at the summit of the stem.

The roots are perennial and branching. As found in commerce, they vary from the size of a writing quill to that of the little finger. They are contorted, marked by rough protuberances, and a projecting line which extends the whole length of the root. The bark is corrugated, grayish-yellow, hard, and resinous. It contains the active principles of the root. When chewed its taste is at first sweetish, but soon grows acrid and pungent. It yields its properties to water and to alcohol. They are supposed to depend upon two acids, the *polygalic* and the *virgineic*. The latter has only been found by Quevenne.

Polygalin, polygalic acid, or *senegin* (for it has received all of these names), is a white, pulverulent substance, without smell, and is at first slightly, but afterwards extremely acrid to the taste. It un-

dergoes no change in the air, is slowly soluble in cold water, but dissolves rapidly and completely in boiling water, as well as in alcohol. It is insoluble in ether and the fixed oils. Its watery solution foams greatly when agitated.

The following are officinal preparations of seneka:—

DECOCTUM SENEGÆ.—*Decoction of Seneka.*

A troyounce of bruised seneka in a pint of water is boiled for fifteen minutes, strained, and water added through the strainer, to make the decoction measure a pint. The addition of an ounce of liquorice root masks the acrid taste of the seneka. Dose, a wineglassful three or four times a day. An *infusion of seneka* may be prepared by macerating six hundred grains of the root for four hours in a pint of boiling water in a covered vessel, and straining off the liquid. It may be given in the same dose as the decoction.

EXTRACTUM SENEGÆ.—*Extract of Seneka.*

Three pints of tincture are obtained by percolation from twelve troyounces of powdered seneka, and evaporated to the proper consistence. Dose, from one to three grains.

EXTRACTUM SENEGÆ FLUIDUM.—*Fluid Extract of Seneka.*

It is procured like other fluid extracts by means of glycerin, alcohol, and water. Dose, half a fluidrachm.

SYRUPUS SCILLÆ COMPOSITUS.—*Compound Syrup of Squill.* Vid. *Scilla.*

SYRUPUS SENEGÆ.—*Syrup of Seneka.*

This syrup is prepared by extracting the virtues of four troyounces of seneka with two pints of diluted alcohol, in a percolator, evaporating to half a pint, and making a syrup with the addition of fifteen troyounces of sugar. Dose, one or two fluidrachms.

History.—Seneka was introduced into practice by Dr. Tennent, of Virginia, as an expectorant, and as a specific for rattlesnake bite, but it has long since lost all claim to the latter distinction. Its efficacy in pulmonary affections was very early appreciated, and it continues to enjoy a high repute in their treatment.

Action.—The operation of seneka closely resembles that of squill. Sundelin took a scruple of the powdered root three times within six hours. It produced a smart and unpleasant irritation of the posterior fauces and throat, with a copious flow of saliva. Soon afterwards a decidedly burning sensation was experienced in the stomach, which, after the third dose, was replaced by painful choking and a violent vomiting of this mucus. The skin, meanwhile, grew moister and warmer. Sharp colic ensued, and a watery diarrhœa. The urine was at the same time augmented, and scalded somewhat when voided. On the following day a painful constriction at the epigastrium was experienced, with loss of appetite. In larger doses seneka excites severe burning pain in the stomach, with violent vomiting, purging, anxiety, and giddiness.[1] Sundelin

[1] Heilmittellehre, ii. 176.

compares it to arnica in its operation on the nervous system, although it excites the secretory functions much more than that medicine. While it stimulates the circulation, it is not heating in its action. From Böcker's experiments, seneka would appear to act but slightly upon the urinary secretion. It merely increases somewhat the proportion of solid matters in that fluid.[1] Schroff found that polygalin, in the dose of from one-third of a grain to three grains, greatly augmented the secretion of bronchial mucus.

Uses. *As an Expectorant.*—It was employed in the treatment of *pneumonia* and *pleurisy*, by Tennent (1736), after the febrile action had been somewhat reduced by depletion. But it was soon found to have little efficacy, and, indeed, to be positively injurious, in the active inflammatory forms of the disease. In *typhoid pneumonia*, in the decline of the ordinary form of the disease, and when it attacks old or feeble persons, seneka may appropriately be used, as Chapman judiciously advised.[2] It is also decidedly beneficial in *subacute* and *chronic inflammation of the bronchia*, and in *bronchorrhœa*. On the other hand, also, when the pulmonary secretion is tenacious and scanty, this medicine appears to render it more abundant and more liquid. It is this property which induced Bretonneau to employ seneka associated with calomel, in *croup*, when the mucous membrane is dry and the cough hard and unproductive.[3] The use of seneka in croup originated with Archer, of Virginia, in 1791, but he by no means confined the treatment to this remedy. On the contrary, he used depletion, purgatives, calomel, and even tartar emetic. It is probable that many of his cases were examples of spasmodic laryngitis. However this may be, many American and European physicians at first confirmed his estimate of the remedy.[4] But after a time the more sober and settled judgment seemed to be that seneka is very useful in the catarrhal stage which succeeds an attack of croup, by restoring the mucous membrane of the larynx to its normal condition.

Seneka was first employed in the treatment of *amenorrhœa* by the late Dr. J. Hartshorne, of this city, previous to 1809. He used the decoction, administering it during the fortnight preceding each menstrual epoch, and found that it sometimes induced a flow of the menses without alleviating the disease which accompanied their suppression.[5] After him, Dr. Chapman made use of this medicine with sufficient success to warrant him in recommending it as "one of the most active, certain, and valuable of emenagogues." He directed about four ounces of the decoction during the day, and increased the dose as far as the stomach would bear it on the approach of the menstrual period. Other writers, and Dr. Eberle among them, have regarded the above estimate of its emmenagogue virtues as altogether exaggerated.

The experience of Dr. Chapman bears out the results of Böcker's

[1] Beiträge zur Heilkunde, ii. 38.
[2] Therapeutics, i. 358.
[3] Traité de la Diphthérite, p. 241.
[4] VALENTIN, sur le Croup, p. 371.
[5] Eclect. Repert., ii. 101.

experiments cited above. Dr. C. states that he did not discover any extraordinary operation from it on the *kidneys*, and that the cases of dropsy in which it seemed chiefly useful, were those connected with a constitutional cachexia.

Wendt, Chelius, v. Ammon, and other German writers, attribute to the medicine a very problematical influence over *scrofulous inflammations* of the conjunctiva, cornea, etc., including those which involve a rheumatic or gouty element.[1]

Administration.—The dose of powdered seneka is from *ten* to *twenty* grains. The dose of the *decoction* is *two fluidounces;* of the *extract*, *one* to *three grains;* and of the *fluid extract* about half a fluidrachm. Of these preparations the decoction is the most efficient; but for children and delicate persons the syrup or fluid extract is to be preferred. The *syrup* is used as an expectorant in the dose of *one fluidrachm.*

CIMICIFUGA.—CIMICIFUGA.

Description.—The root of *Cimicifuga racemosa*, *black snakeroot*, or *cohosh*, a native plant of the United States. It grows in shady and rocky woods. The stem is from three to eight feet high, herbaceous, and somewhat furrowed. The leaves are decomposed; the flowers are white and arranged in a long terminal raceme. When fresh, the root is large, black, and fleshy; as found in the shops, it consists of a blackish, rough, and contorted body furnished with slender radicles. It is whitish internally, and has a peculiar and disagreeable odor, and a bitter, astringent, and somewhat acrid taste. It yields its specific virtues to alcohol and water, but more perfectly to the former. The resinoid substance obtained by evaporating a strong tincture of cimicifuga has been denominated *cimicifugin.*

History.—We are indebted to Dr. Garden, of Wyliesburg, Virginia, for its introduction into medicine, in 1823, but this gentleman states that it was previously in common use as a popular remedy in many parts of the western country.[2]

EXTRACTUM CIMICIFUGÆ FLUIDUM.—*Fluid Extract of Cimicifuga.* Sixteen troyounces of powdered cimicifuga are treated by percolation with a pint and a half of stronger alcohol, and a sufficient quantity of diluted alcohol, to the production of a pint and a half of tincture. This is reduced by spontaneous evaporation to twelve fluidounces. Percolation is then continued with diluted alcohol until two pints more of tincture have been obtained, which are reduced by evaporation to four fluidounces and added to the tincture first obtained. The whole is then filtered. *Dose*, fifteen to twenty minims.

[1] STRUMPF, Handbuch, ii. 118.
[2] Med. Recorder, vi. 609.

Action.—Dr. Chapman[1] says that, "given so as to affect the system, we find, first, some nausea, followed by greater freedom of expectoration and more or less relaxation of the surface, with slight nervous tremors, and vertiginous affections. The pulse, during this state, is considerably lowered, and is apt to remain so for some time." This statement is essentially confirmed by Dr. Davis,[2] the most recent writer upon the subject, who says: "In large doses it produces vertigo, dimness of vision, and a depression of the pulse, which continues for some time." In medicinal doses, Dr. Young[3] did not find it either to vomit or purge, nor yet to increase the perspiration or the urine, nor did it affect the pulse, but produced only an uneasy feeling amounting to an ache through all the extremities, and lasting from one to four hours. Dr. Davis, like previous observers, could not detect a perceptible increase in any of the secretions, nor the manifestation of any stimulating qualities. On the whole, it seems to present a striking analogy to colchicum in its action.

Uses.—The success of cimicifuga as a popular remedy for *chorea*, led to its being introduced into the regular treatment of that disease, by Dr. Young, of Chester County, Pennsylvania, in 1831. It had, however, been used by Dr. Physick, as much as ten years earlier. Dr. Young prescribed the powdered root in teaspoonful doses three times a day.[4] Successful cases were also reported by Dr. Lindsly,[5] and by Dr. Kirkbride,[6] which were treated by himself and by Drs. Otto and Wood. There is no doubt that it is one of the most valuable remedies which can be employed in this disease. The cases which are peculiarly adapted to its use, are those in which the nervous derangement is independent of any definite disease in the other parts of the body. The remedy, too, must be used in doses of sufficient strength to develop its specific effects, particularly vertigo and confusion of sight.

Dr. F. N. Johnson, of New York, used cimicifuga with very satisfactory results in many cases of *acute inflammatory rheumatism*.[7] It induced no sensible evacuations, and no symptoms except diminishing the force and frequency of the pulse, and causing the pain to disappear. Dr. Simpson, of Edinburgh, says: "I have found it in my own case repeatedly cure an attack of *lumbago* with wonderful rapidity." In chronic rheumatism it does not seem to have any peculiar value.

An English writer[8] is disposed to admit the correctness of the observations of American physicians who allege that it has a peculiar action upon the *uterus*. "In the irritable condition of that organ," he remarks, "often observed in patients for some time after menstruation had ceased, or irregular when about to cease, and marked by pain more or less periodical in the lumbar region, cimi-

[1] Elem. of Therapeutics, 6th ed. (1831), i. 357.
[2] Trans. Am. Med. Assoc. (1840), i. 352.
[3] Am. Journ. of Med. Sci., ix. 313.
[4] Ibid., ix. 313 and xiii. 57.
[5] Ibid., xxii. 254.
[6] Ibid., xxv. 288.
[7] Trans. Am. Med. Assoc., loc. cit.
[8] Lancet, Aug. 1862, p. 238.

cifuga affords rapid relief. In neuralgic pains, often met with in such patients in other localities, it is equally beneficial." Dr. D. A. Morse,[1] who claims for the medicine a similar virtue, maintains it to be equally efficient in *amenorrhœa*. He advises that its use should be continued although it fail to restore the menstrual flow at the first period after its administration; maintaining that if it be persisted in for two months a cure will rarely fail to follow. The same writer urges its advantages as a remedy for *spermatorrhœa* and *nocturnal emissions*, asserting that it gives tone to the nervous system, removes irritation, and procures sound and refreshing sleep.

Pulmonary Affections.—The original use of the medicine by Dr. Gardner, was in cases of what he regarded as *tuberculous consumption*. It is, however, easy to perceive that they were not tuberculous, but inflammatory, cases in fact of bronchitis, attended with profuse purulent expectoration. In this affection it was eminently beneficial, administered as it was until its effects upon the head were perceptible. A criticism like that just suggested may be made upon cases reported by Dr. Hildreth, as of phthisis cured by cimicifuga.[2] They appear to have been instances of *bronchitic inflammation*, and perhaps of "scrofulous induration" (which is only a form of *chronic pneumonia*), at the summit of one or both lungs. They were, however, vastly benefited, if not cured, and plainly owed their improvement to the use of the medicine.

Administration.—Cimicifuga yields its specific virtues to alcohol more perfectly than to water. Hence it should generally be used in the form of a *fluid extract*, or in *substance* pulverized. (*Davis.*) In acute rheumatism, from *fifteen to twenty minims* of the *fluid extract*, or *twenty grains* of the powder, may be given to an adult every two hours until its effects are manifested. A *decoction* may be prepared by boiling for a short time an ounce of the bruised root in a pint of water. *One or two fluidounces* may be given for a dose.

ALLIUM.—Garlic.

Description.—The officinal article is the bulb of *A. sativum*. Under this head may be included all the species of the genus *Allium*, of which there are said to be more than one hundred and sixty.[3] They abound in almost every part of the world, but *A. sativum*, or garlic, *A. cepa*, or onion, and *A. porrum*, or leek, which are most commonly in use, especially for culinary purposes, are not indigenous to this country. The bulb is the part employed in the kitchen and in the laboratory. In garlic it is composed of prismatic segments called *cloves*, but in the onion and leek it is tunicated.

These plants contain a strong volatile principle, on which their acrid taste depends, and a peculiar penetrating odor termed *alliaceous*, which is apt to excite a flow of tears. When the juice of garlic

[1] N. York Med. Journ., v. 70. [2] Am. Journ. of Med. Sci., Oct. 1842, p. 281.
[3] Dieu, Mat. Med., iii. 83.

is applied to the skin, it acts as a rubefacient, and even as a vesicant, in virtue of this principle. It is wholly driven off by boiling, which renders the bulb mild and somewhat sweetish to the taste. Wertheim describes the ethereal oil of garlic as producing, when rubbed upon the skin, severe pain and inflammation.

SYRUPUS ALLII.—*Syrup of Garlic.*

This preparation is made by macerating six troyounces of fresh garlic with a pint of diluted acetic acid, filtering the liquor, and converting it into a syrup with two pounds of sugar. Dose, for a child a year old, a teaspoonful.

History.—Several species of allium, and especially those already named, have been known from a high antiquity. They are mentioned by Hippocrates, and Pliny treats of them separately and fully. By these and subsequent writers all of the qualities are fully described which modern observation has detected in them. Dioscorides states that fresh onions are stronger than such as have been kept, or have been prepared with vinegar and salt. They are, he says, biting, carminative, appetizing, and attenuating; they excite thirst, produce nausea and vomiting, and loosen the bowels. Of garlic he adds that it is a rubefacient, stimulant, and diuretic. Several ancient writers state that the juice of these plants clears the sight and removes opacities of the cornea and granulations of the conjunctiva; that ointments into which it enters cure alopecia and various chronic eruptions of the skin, form an excellent stimulant dressing for excoriations, and relieve deafness and singing of the ears when instilled into the auditory canal. Garlic was likewise held to be a sovereign remedy for the bites of serpents and of mad dogs, and onions roasted or boiled in water or milk were universally used as poultices for boils, carbuncles, unhealthy sores, etc. Garlic is recommended externally and in gargles for quinsy; and in amenorrhœa a clove of garlic, or the juice of a leek, is directed to be applied to the os tincæ.

Internally, garlic is said to dissipate intoxication from wine, and also to be an aphrodisiac. Hippocrates declared leeks and garlic to be emmenagogue, and an Arabian writer asserts that the latter renews the vigor of persons exhausted by venereal excesses. All are agreed on its excellence in pulmonary disorders, particularly those of a chronic sort attended with purulent expectoration. It is marvellous in commencing dropsy, says one writer, and Hippocrates declares its peculiar power to be diuretic. Several laud it as a remedy for intestinal worms, and particularly for tænia and ascarides.[1]

Action.—Applied to the skin, bruised garlic produces redness and painful irritation, and sometimes even vesicates. Internally, it is a gentle stimulant of the digestive organs, and is supposed to

[1] Compare EBN BAITHAR, Heil- und Nahrungsmittel, i. 142, 230; PLINY, Hist. Nat., lib. xx. ch. xx. et seq.; ORIBASE, Trad. de BUSSEMAKER and DAREMBERG, ii. 190, 363, 364.

augment the secretion and muscular vigor of the stomach. In overdoses, it occasions nausea, vomiting, colic, and diarrhœa. Its secondary action is to increase the renal and cutaneous secretions. Its absorption is demonstrated by numerous facts; the breath, the urine, the perspiration, the milk, all exhale its characteristic smell, which has also been detected in the secretion of ulcers upon persons who had eaten of garlic. Even when it is applied to the soles of the feet, its taste has been perceived in the mouth and upon the breath of the patient. Owing to its stimulant properties, garlic is extensively used as a condiment in warm climates, and particularly in the southern countries of Europe, where it is held to facilitate the digestion of fatty substances and crude vegetables, such as salads. Garlic is said[1] to possess the property of hindering animal decomposition, whence it is a prominent ingredient of the sausages of Spain, Italy, and the South of France. It is also alleged to have the power of preventing the fermentation of must, *i. e.*, the unfermented juice of the grape.

Uses.—The smell of bruised garlic is frequently employed to rouse persons from a *swoon*, or to put an end to *hysterical* paroxysms. In modern times, as in ancient, cases have been reported of persons cured of *hydrophobia* by eating a large quantity of garlic.[2] In a somewhat analogous disease, *tetanus*, Valentin states that he made use of this medicine successfully by administering it internally and by frictions along the spine and limbs. When the *digestion* is feeble from mere exhaustion, a very small quantity of garlic taken with the food enables the stomach to digest it, particularly in hot seasons and climates. The habit of mixing sliced onions and cucumbers together is a familiar illustration of this dietetic truth. Garlic is still thought to have power as a *vermifuge*,[3] and it has even been found successful in expelling tænia. Clysters of milk containing the juice of garlic, and also the vapors of garlic introduced into the rectum through a funnel, have been used to destroy *ascarides*, but are somewhat objectionable on account of their offensive smell. Onions have been used successfully to procure the evacuation of *dropsical effusions*, and particularly of anasarca produced by cold. Sydenham and Cullen both recommended garlic as a remedy for dropsy. Cases of excessive *anasarca* are reported by Claudot[4] in which the patients were restricted to a diet of bread and milk with onions, both raw and cooked. Copious diuresis followed, and a perfect cure.

Syrup of garlic, or the domestic onion syrup, is one of the most generally used of all the *expectorant* remedies, particularly with children. It should not be administered during the febrile stage; but when this is past, it contributes materially to the resolution of the attack. In the chronic forms of *infantile* and also of *senile catarrh* it will be found a useful medicine. Cazin reports that in

[1] DIEU, op. cit., iii. 90. [2] Ibid.
[3] EBERLE says (Thérap., p. 417): "I have known it to be given with decided advantage for the purpose."
[4] Bull. de Thérap., xlv. 363.

epidemic *pseudo-membranous angina* or *diphtheria*, he found a local application of lemon-juice and garlic-juice, with the internal administration of one part of this mixture to three of syrup of hyssop and one of gum syrup, a very efficient remedy.[1]

Externally, a cataplasm of bruised garlic or an onion poultice is often applied to the chest or throat in inflammations of these parts. Anciently it was used as a *revulsive* to the feet in affections of the head. The juice, mixed with oil or spirits, is a popular embrocation in *convulsions*, *whooping-cough*, and other nervous disorders among children. A clove of roasted garlic, or a pledget of wool saturated with garlic juice, is a good stimulant application to the auditory canal in deafness produced by cold. In *abscess of the ear* the central portion of a roasted onion introduced into this tube forms a convenient and admirably soothing application. Roasted onion may be of use as a poultice to the perineum in *strangury* and other *irritations of the bladder;* and bruised garlic in *atony* of this organ.

Administration.—The modes of employing the alliaceous vegetables have been briefly indicated in the course of this article. Cloves of garlic may be given in substance, after having been cut into small pieces, or the expressed juice administered with milk and sugar, in the dose of *half a fluidrachm*. Of the syrup a *teaspoonful* may be given to a child one year old.

AMMONIACUM.—Ammoniac.

Description.—Ammoniac is a gum-resinous exudation from *Dorema Ammoniacum*, a plant which grows in Southern Persia, between Ispahan and Shiraz, in warm, sunny localities, and in dry and stony soils. The sap, which is very abundant, exudes from small punctures made in the leaves and tender twigs, artificially or by the sting of an insect, and, on hardening, forms the rounded masses which occur in commerce. These may be either separate or more or less fused together. They vary from the size of a pea to that of a walnut, are more or less spheroidal, of a reddish-yellow color and waxy lustre without, and white within, opaque, more or less adherent to one another, and soften by the heat of the hand. Ammoniac has a peculiar and unpleasant smell, particularly when heated, and a bitter, acrid taste. It consists chiefly of an essential oil, resin, and gum.

The principal officinal preparations of ammoniac are these:—

Emplastrum Anmoniaci.—*Plaster of Ammoniac.*

The ammoniac is reduced to the proper consistence by solution in diluted acetic acid, and evaporation. It is an active stimulant of the skin.

Emplastrum Ammoniaci cum Hydrargyro.—*Plaster of Ammoniac with Mercury.*

[1] Bull. de Thérap., lv. 327.

This plaster is made with ammoniac, mercury, olive oil, and sublimed sulphur. The mercury is combined with the oil and sulphur by heat and trituration, and then ammoniac dissolved by boiling water is incorporated with the other ingredients.

MISTURA AMMONIACI.—*Mixture of Ammoniac.*

This is made by rubbing one hundred and twenty grains of ammoniac with half a pint of water, and straining the mixture. Dose, one or two tablespoonfuls.

PILULÆ SCILLÆ COMPOSITÆ.—*Compound Pills of Squill.* Vid. *Scilla.*

Action.—According to the greater number of writers, ammoniac excites the circulation and quickens the organic functions. Its continued use enfeebles the digestive organs, and in large doses it purges and is said to produce a measly eruption. In overdoses it causes colic, diarrhœa, and vomiting. Externally, in the form of a plaster, it occasions a papular eruption. For these reasons it is generally regarded, and with sufficient reason, as a stimulant. It is, however, stated by Trousseau and Pidoux[1] that the persons to whom they administered it gave no indication of its stimulant action either locally or generally. One of these gentlemen took one hundred and twenty grains of it without experiencing any symptoms of the sort referred to.

Uses.—The most important application of this medicine is to certain *bronchial* complaints, in which the secretion is superabundant and its expectoration difficult, and when there is also an entire absence of febrile excitement. The latter condition is insisted upon by all competent authorities, a fact which shows a belief in the stimulant operation of the medicine. Indeed, some have declared that, neglecting this precaution, they have seen it produce dyspnœa, and even hæmoptysis. In forms of bronchorrhœa accompanying emphysema of the lung and asthma, it is eminently beneficial.

By some writers, particularly of the German schools, it is recommended with marked emphasis in various hypothetical states of the *abdomen*, as infarction, torpor, etc., of the lymphatics and portal circulation, and in dropsy depending upon these conditions. So far as it is possible to conjecture, the states corresponding to these descriptions constitute organic diseases of the liver, spleen, mesentery, uterus, ovaries, etc., in which it is evident that ammoniac can be of no avail whatever. Indeed, this is rendered certain by the medicine having been in every instance combined, by those who prescribed it, with purgatives, diuretics, mercurials, and other alteratives, to which alone whatever benefit followed its use can be attributed.

Externally, plasters of ammoniac operate as discutients in chronic rheumatism, white swelling, and other chronic affections of the

[1] Thérapeutique, ii. 188.

joints, as well as in cold abscesses and subcutaneous effusions of blood, and indolent tumors generally.

Administration.—Ammoniac may be given in pill, but is preferable in emulsion. From ten to thirty grains may be taken at a dose. Several plasters containing ammoniac, besides the *Emplastrum Ammoniaci*, are officinal; one of the most efficient is the *Emplastrum Ammoniaci cum Hydrargyro*, which is much employed as a discutient. The mercury which it contains sometimes affects the gums.

MYRRHA.—Myrrh.

Description.—Notwithstanding the ancient and general use of myrrh, the plant from which it is procured remained undescribed until within a few years, when an account of it was furnished by Ehrenberg and Hemprich, under the title of *Balsamodendron Myrrha*. It is a thorny shrub which grows in Arabia Felix, Upper Egypt, Nubia, and Abyssinia. A juice exudes from its surface, which at first is thin and of a light-yellow color, but subsequently concretes and acquires a darker and reddish hue.

Myrrh has a strong, pleasant, aromatic, and peculiar odor; its taste is warm, aromatic, bitter, and somewhat acrid. It grows soft by chewing, and is ultimately dissolved by the saliva. It is readily inflammable, and is partially soluble in water, rendering the fluid milky. Alcohol and ether dissolve its resinous portions only. Alkaline solutions dissolve it very well, but not so completely, it is said, as may be done by triturating it with four parts of hydrochlorate of ammonia and one hundred and sixty of water. The difficulty of dissolving myrrh arises from its containing, besides ordinary gum and resin, a volatile oil and a gum insoluble in water.

Myrrh enters into the composition of several officinal preparations described in other articles, viz., *Compound Mixture of Iron*, *Pills of Aloes and Myrrh*, *Compound Pills of Iron*, *Compound Pills of Galbanum*, and *Compound Pills of Rhubarb*.

Tinctura Myrrhæ.—*Tincture of Myrrh.*

It is prepared by percolation with alcohol from three troyounces of powdered myrrh so as to obtain two pints of tincture. It is hardly ever used internally, but may be prescribed in doses of half a fluidrachm.

Tinctura Aloës et Myrrhæ.—V. *Aloes.*

History.—Myrrh was very anciently employed in medicine. The earliest account of it is contained in the description of the ointment which the Jews employed in the rite of consecration.[1] It is also mentioned in the Bible amongst the articles used in the purification of women,[2] as an emblem of purity and soundness,[3] as

[1] Exodus, xxx. 23. [2] Esther, ii. 12. [3] Psalms, xiv. 8.

a perfume,[1] and as one of the substances employed in embalming.[2] By the Greek physicians myrrh was applied externally for ophthalmia, for painful swellings and wounds, along with other local excitants for alopecia, with vinegar for freckles, in order to dry up chronic discharges, to correct fetid exhalations from carious teeth, from the axillæ, and other parts, etc. Internally it was directed for the relief of chronic pulmonary catarrh and chronic fluxes of the kidneys and bowels, for hysteria, for promoting menstruation and procuring abortion, for intermittent fever, etc. In nearly all these cases myrrh was given in combination with various stimulants and tonics.

Action.—In small doses, myrrh increases the appetite and quickens the digestion. In somewhat larger quantities it promotes the intestinal secretions, and in doses of thirty or forty grains it excites a disagreeable sensation of heat in the stomach, with nausea, vomiting, and even diarrhœa; the pulse is at the same time rendered fuller and quicker, a warmth is diffused through the whole body, and is most sensibly felt in the mucous lining of the air-passages, while all of the secretions are promoted. Myrrh has been supposed to possess a specific property of promoting menstruation; but whether this be really so, or the effect merely of the stimulating qualities of the medicine, is still undetermined. According to Richter,[3] it is peculiarly adapted to relieve states of torpor, inactivity, and insensibility, with deficient excitability, of the vascular system, but is contraindicated by plethora, inflammation, active hemorrhage, and morbid susceptibility combined with either of these states. The same author dissuades from its use during pregnancy. On the whole, myrrh may be regarded as at once tonic and stimulant. Its local action is moderately astringent and stimulant.

Uses.—Myrrh is seldom employed alone, but is prescribed in various combinations with advantage. It has been found very useful in *atonic dyspepsia* characterized by flatulence, mucous evacuations, constipation, and associated nervous disorders of a hysterical or hypochondriacal nature. In this affection it is advantageously associated with vegetable bitters and ferruginous preparations.

Myrrh was formerly much employed in *pulmonary diseases*, and was indeed supposed to possess specific virtues in such complaints; but its tendency to excite hæmoptysis and produce oppression of the breathing has tended to direct its use rather to *chronic* pulmonary catarrhs, with profuse expectoration, but unaccompanied with fever. The more unequivocal is the absence of vascular excitement, the greater is the benefit to be expected from myrrh. It, however, does not excel, if indeed it equals, under these circumstances, the terebinthinate preparations, with which it may be advantageously associated, or with tonic expectorants, such as Iceland moss, or with preparations of cinchona, iron, and other pure tonics. The celebrated *Griffith's mixture* (*Mistura Ferri Composita*), which con-

[1] Proverbs, vii. 17. [2] St. John, xix. 39. [3] Op. cit., ii. 43.

tains both myrrh and iron, owes its efficacy in chronic catarrhs to these ingredients. Chronic mucous fluxes of the *digestive and urinary organs*, when once the inflammatory element has disappeared, are favorably influenced by myrrh, alone or in combination with astringents. Like all excitants, however, it must be used in these diseases with great circumspection. *Amenorrhœa* and scanty menstruation, when they depend upon a cold, relaxed, and torpid state of the system, are benefited by myrrh, especially when in combination with iron, as in Griffith's mixture.

The *external applications* of myrrh are not unimportant. It has been recommended as a dressing for *wounds* that are slow of healing, when the granulations are pale and flabby and the pus is of an ichorous nature, for those in which the discharges are offensive, and for all the morbid conditions that denote a feeble recuperative action in ulcerated surfaces. One of its most familiar uses is to remedy the softened and swollen condition of the *gums* which is apt to accompany dyspepsia and scorbutic affections. In such cases the repeated use of a mixture of tincture of myrrh with water (fʒj to f℥vj) tends to strengthen the gums and promote their healing, while it corrects the offensive odor of the breath.

Administration and Dose.—Myrrh may be given in *substance*, in *pill*, or *powder*, and in doses of from *five* to *fifteen* or even *thirty grains*. The *emulsion* may be conveniently administered as an *enema*. The *tincture* is seldom prescribed internally, but is of common use as a mouth-wash and gargle.

BALSAMUM PERUVIANUM.—Balsam of Peru.

Description.—An empyreumatic liquid balsam obtained from *Myrospermum Peruiferum*, a tree "which grows in Central America, in the State of St. Salvador, upon the Pacific coast."

It is of a deep reddish-brown color, resembles honey in consistence, and has a very fragrant smell, which has been compared to that of vanilla and benzoin, and which is rendered more powerful by heat. Its taste is warm and bitter, and it leaves an acrid sensation in the fauces. On burning, it gives off a dense white smoke. Its principal constituents are resin, a peculiar oil, and cinnamic acid.

Action.—Balsam of Peru is a general stimulant, but acts most decidedly upon the mucous membranes. According to Mitscherlich,[1] it promotes digestion, but in large quantities excites heat and oppression in the stomach, nausea, vomiting, colic, and diarrhœa. In full medicinal doses, and long continued, it occasions some degree of general excitement and warmth, renders the pulse more frequent, and augments the secretions of the skin and kidneys. In common with other balsamic agents, it has long been thought to exert a healing influence upon wounds, ulcers, and almost every

[1] Lehrbuch, ii. 236.

lesion of the solids. Indeed, the very term balsam has become a universal name for that which heals and soothes: *dulcissimum balsami nomen est*, says Hoffmann.

Uses.—The remark was very justly made by Dr. Chapman, that our resources in the treatment of pulmonary affections have been injuriously abridged by the fears which have been entertained of stimulant remedies. The abuse of them must unquestionably be pernicious, and their employment in febrile affections of the chest was justly, as well as strongly denounced by Fothergill. This led to their comparative neglect, and the evil influence was sustained by the lukewarm if not mischievous apathy of the physiological school of physicians. There is now a tendency to a more rational and humane practice, and thousands of cases of bronchial diseases are cured, which formerly would have been allowed to run their course without active resistance, and many lives are prolonged which once were listlessly permitted to terminate prematurely.

At one time the balsams were celebrated as remedies for "consumption," a term which included several forms of disease besides the tuberculous, and particularly *chronic bronchitis*, which even now in its more aggravated varieties is constantly mistaken for true phthisis. The celebrated balsamic pills of Morton[1] were used by him, and long after him, in every form of chronic pulmonary disease, attended with copious and especially purulent expectoration. Hoffmann, referring, no doubt, to the forms of disease which Morton had in view, says: "I have seen persons laboring under perfectly-formed phthisis, and seriously affected for several years, happily restored by the use of this very balsam." It is certain that at the present time such stimulant expectorants are too much neglected, even in cases of tubercular phthisis, when the secretion is so excessive as by its quantity alone to undermine the patient's strength. The only contraindication to their use is fever.

When the *larynx* is the seat of *chronic inflammation*, and even of ulceration, which is nearly always tuberculous, the inhalation of the vapors of benzoin, Tolu, or balsam of Peru, diffused through the air of the patient's room by being thrown upon hot coals, or inhaled from a proper apparatus, as originally recommended by Hoffmann,[2] tends materially to promote the healing of the ulcers, and to lessen the discharge, and thus, by diminishing the necessity for coughing, to husband the patient's strength.

Hoffmann also recommended this medicine in *chronic fluxes* of the bowels, to be given by the mouth or in enemata, and Trousseau and Pidoux, in imitating the practice, declare it to be of great service when the bowels continue to be irritable after *typhoid* fever, and when after *dysentery* mucous dejections and tenesmus persist.

[1] "Take of the powder of wood-lice, prepared, three drachms; of the finest gum ammoniac, a drachm and a half; of the flowers of benzoin, two scruples, or a drachm; extract of saffron, balsam of Peru, of each, half a scruple; of balsam of sulphur, terebinthinate or anisate, a sufficient quantity. Mix them and make them into pills, etc."

[2] De Balsamo Peruviano, Op. Om., Suppl. i. 741.

In flatulent and *colicky* affections of the intestinal canal, with a disposition to nausea and vomiting, this balsam may be used with great benefit if associated with tonics and stimulants.

In *gonorrhœa* it is inferior to copaiba, but after purgation it is sufficient, according to Hoffmann, to accomplish the cure of both mild and malignant gonorrhœa. It may also be used advantageously in *leucorrhœa* if associated with bark and iron.

It is said to have been successfully employed in *convulsions* produced by suppressed perspiration, and even in those of a *tetanic form*.[1] Such is also the assertion of Dr. Kollock, of Savannah, who used it both internally and externally, and found that of itself it "restored the patient when rapidly sinking under the very liberal use of opium, wine, and bark." The maximum dose given by this physician was one hundred and twenty grains in twenty-four hours. In these cases it must be suspected that the balsam had but little to do with the cure, apart from its stimulant action, which co-operated with that of the wine.

Externally, balsam of Peru has been much employed to promote the healing of wounds in parts of inferior vitality, and in phagedenic and indolent ulcers. In ulceration of the nipples, the following preparation will be found useful: ℞.—Balsam. Peru. gr. cxx; ol. amygdal. gr. xc; gummi Arab. gr. cxx; aq. rosæ, f℥j.—M. S.—Apply five or six times daily. Or, simply, sixty grains of balsam of Peru to one hundred and twenty grains of glycerin ointment. If pain is then excited, the proportion of balsam may be diminished. Dr. Mankiewicz cured a case of obstinate *eczema* of the face by the application of this balsam twice a day for five or six weeks.[2] It is also said to be one of the most efficient applications to atonic ulcers of the *cornea*.[3] A liniment containing some astringent substance with the balsam of Peru, is an excellent application to parts discharging offensive pus, such as the ears, the nose, the vagina, etc. A plaster composed of diachylum, opium, and Peruvian balsam is recommended as a palliative for *chilblains*.

Internally, the dose is *half a fluidrachm*, which may be given in an emulsion of almonds, gum Arabic, or yelk of eggs, with the addition of sugar. Balsam of Peru is an ingredient of the compound tincture of benzoin.

BALSAMUM TOLUTANUM.—Balsam of Tolu.

Description.—A semi-liquid balsam obtained from *Myrospermum Toluiferum*, a tree which grows upon the mountains of Tolu, and in other districts of South America and Mexico. It is procured by making incisions in the bark. When fresh, it is soft and tenacious, but it becomes hard and brittle by age. It is yellowish, transparent, and fragrant; it softens under the heat of the hand,

[1] Richter, Ausferlich, Arzneim., ii. 85. [2] Edinb. Med. Journ., xv. 570.
[3] Practitioner, vii. 304.

and has a pleasant, sweetish, and aromatic taste. It readily inflames, and diffuses an agreeable odor. It is soluble in alcohol, ether, and the volatile and fatty oils. It contains resin, a volatile oil, and cinnamic acid.

The officinal preparations of Tolu are:—

SYRUPUS TOLUTANUS.—*Syrup of Tolu.*

This syrup is prepared from tincture of Tolu, carbonate of magnesia, sugar, and water. It is a pleasant ingredient of pectoral and other mixtures, but possesses no marked medicinal virtues.

TINCTURA TOLUTANA.—*Tincture of Tolu.*

This is a solution of three troyounces of balsam of Tolu in two pints of alcohol. It is used for the same purposes as the syrup, and for flavoring troches.

TINCTURA BENZOINI COMPOSITA.—Vid. *Benzoin.*

Action and Uses.—They are the same as those of the balsam of Peru, but less remarkable. Its more agreeable flavor and milder qualities render the balsam of Tolu an eligible ingredient of mixtures, lozenges, vapors, etc., intended to modify subacute and chronic inflammations of the mucous membranes, and those of the lungs, especially. It is also much used by perfumers, particularly as an ingredient of burning pastilles.

Balsam of Tolu may be administered in emulsion, and in doses of from *ten* to *thirty* grains. The *syrup* is most generally used to flavor mixtures. It is associated with benzoin, storax, and other stimulants, in the compound tincture of benzoin and in the preparation known as Turlington's balsam.

BENZOINUM.—BENZOIN.

Description.—A solid balsam obtained from *Styrax Benzoin.* This tree is a native of Sumatra and the neighboring islands of the Eastern Archipelago. It has a trunk of one or two feet in diameter, from which the juice is obtained by incisions in the bark, and sometimes by boiling the wood. In commerce, that obtained by incisions is generally found in the form of whitish *tears*, and is the purest variety; the other occurs in brownish or blackish masses, generally without tears. But the two sorts are often mixed.

Benzoin has a very fragrant ordor; its taste is at first sweetish and aromatic, but it leaves behind an acrid irritation in the mouth and fauces. It is readily pulverized, and its particles diffuse themselves through the air and excite sneezing. It is wholly soluble in alcohol, and partially so in boiling water. When thrown upon hot iron it emits thick and penetrating fumes of benzoic acid chiefly, which readily condense upon any cold substance. This acid constitutes between eight and fifteen per cent. of benzoin, and unites with lime and alkaline bases. Crystals of benzoic acid are known as *flowers of Benzoin.* They are colorless, have an agreeable

›matic odor, and a warm, acrid, and acidulous taste. They are
uble in two hundred parts of cold and thirty of boiling water,
alcohol, ether, and the fixed oils. Benzoin contains also a trace
a volatile oil, and a resinous substance which forms more than
ır-fifths of its whole bulk.

ACIDUM BENZOICUM.—*Benzoic acid.*
This acid is obtained from benzoin by sublimation.

TINCTURA BENZOINI COMPOSITA.—*Compound Tincture of Benzoin.*
This is a filtered solution of three troyounces of benzoin, half a
›younce of socotrine aloes, two troyounces of storax, and a troy-
nce of balsam of Tolu in two pints of alcohol. Dose, half a
idrachm.

UNGUENTUM BENZOINI.—*Ointment of Benzoin.*
It is made by heating together a troyounce of powdered benzoin
d sixteen troyounces of lard.

AMMONII BENZOAS.—*Benzoate of Ammonium.*
This salt is procured by the addition of benzoic acid to water of
ımonia. It is in minute, white, shining, thin, four-sided laminar
'stals, with a slight odor of benzoic acid, and a bitterish, saline,
newhat balsamic taste, and a slightly acrid but persistent after-
ıte. It is soluble in water and alcohol.

Action.—We possess no accurate experimental knowledge of the
eration of benzoin upon the human economy. It is generally said
have little or no influence upon the digestion, but in large doses
quicken the circulation and increase the urine and the exhala-
n of the skin. These properties are usually attributed to the
ızoic acid which it contains; but, however true this may be of
action upon the urine, we must rather attribute its efficacy in
lmonary diseases to the resinous element. Pure benzoic acid,
en slightly warmed, exhales an aromatic fragrance. Schreiber[1]
›k half an ounce of it in forty doses in the course of two days.
experienced a prolonged irritation of the throat and a sense of
rmth, first in the abdomen, and then over the whole body. The
lse grew more frequent, and afterwards subsided gradually.
ter the first day, the perspiration and expectoration were aug-
nted, but the quantity of urine was unchanged; the head was
newhat confused, and the digestion was temporarily impaired.
cording to Dr. Ure, the administration of benzoic acid causes
disappearance of uric acid from the urine, which is replaced
hippuric acid. Similar statements have been made by Leroy
Étiolles and by Debouy.[2] Keller, on the other hand, maintains
ıt the uric acid remains unchanged, and that the benzoic acid is
ıverted into hippuric acid[3] at the expense, according to Garrod,
the urea, the uric acid meanwhile remaining undiminished.[4]

[1] MITSCHERLICH, ii. 283.
[2] DIEU, iv. 911.
[3] MITSCHERLICH, loc. cit.
[4] Lancet, Nov. 1844, p. 240.

Uses.—The principal use of benzoic acid is to diminish the tendency to the formation of *uric acid* calculus. In spite of the theoretical views above stated, experience has proved that this object may be, partially at least, secured, and the effects of the disease palliated. Upon this ground it was recommended by Golding Bird to be administered in doses of eight or ten grains in syrup, or dissolved in a weak solution of carbonate or phosphate of soda, thrice a day. Cinnamon-water forms an appropriate vehicle.[1] Dr. Ure announced, in 1844,[2] that from ten to twenty grains of benzoic acid, given twice a day, in cases of *phosphatic urine*, is capable of rendering the urine acid, and thus preventing the irritation of the vesical mucous membrane, which is so distressing a symptom of that form of disease.[3] It has also been found by Dr. G. B. Wood[4] to palliate the derangement of function and general distress which accompany phosphatic urine, speedily changing the reaction of the fluid and rendering it transparent. This effect is, however, only to be expected when the state of the urine depends upon disease in the bladder itself. It is of no advantage when phosphatic urine is produced by derangements of the digestive or the nervous system. Benzoate of ammonia has been recommended under the same circumstances by Dr. Holland. "It may be prepared extemporaneously by dissolving five or six grains of benzoic acid and as much sesquicarbonate of ammonia in an ounce of boiling water." In this case the ammonia, while rendering the benzoic acid more soluble, and therefore more absorbable, does not interfere with the appropriate action of the acid upon the urine; for, unlike the fixed alkalies, ammonia is excreted by the lungs and the skin, and not by the kidneys.

Dr. Delcour,[5] and also Dr. Caspar Morris, have treated *incontinence of urine*, without an altered constitution of this secretion, successfully by means of benzoic acid.[6] According to Falck, benzoic acid is a specific remedy for *jaundice*. Dr. Harley found it of signal benefit in cases arising from suppression, and due to "enervation" or to active congestion; but in a case following upon an attack of ague, it proved of no service.

Benzoin was formerly employed much more than at present in chronic affections of the *bronchia*, both in substance and in vapor; but, since it acts as an irritant, care must be taken to restrict its use to cases which will not be injuriously influenced by stimulation. We have used the tincture of benzoin with advantage, by means of the steam atomizer, in the treatment of chronic bronchitis. The compound tincture of benzoin is sometimes used as a *stimulant*

[1] The following is Dr. Bird's formula: ℞.—Sodæ carb. ʒiss; acid. benzoic. ℈ij; sodæ phosph. ʒiij; aq. ferv. f℥iv; solve et adde aquæ cinnamomi, f℥viiss; tinct. hyoscyami, fʒiv.—M. S.—Two tablespoonfuls three times a day.

[2] Prager Vierteljahrschrift, ii. 139.

[3] A striking case of the efficacy of this treatment is contained in the Lancet, Nov. 1863, p. 591.

[4] Trans. Phil. Coll. of Med., March 7, 1855.

[5] Gaz. des Hôpitaux., Dec. 1844.

[6] Trans. Phil. Coll. of Med., March 7, 1855.

xpectorant, and also in the treatment of *chronic diarrhœa* and *dysntery.*[1] Reil states that from his own experience he believes benoic acid to be one of the best expectorants in the bronchial catarrh f old persons.[2] As a local application to *bed-sores*, and to *indolent* nd *gangrenous ulcers*, it is often of signal advantage. Bourdel ecommends the tincture of benzoin as a remedy for *sore nipples.* 'he first application is painful for a few minutes, but the subseuent ones are less or not at all so, and the infant can usually nurse ithout difficulty and without pain to the mother.[3] A saturated lcoholic solution of benzoin and glycerin in equal proportions has een recommended for the same purpose. A mixture of one part f compound tincture of benzoin and four of glycerin, after having een strained, forms the most efficient cure for *chapped hands and ps* that we have ever used. Benzoated cold cream, and the ointent of benzoin, are also excellent applications in cases of the same ature. A simple tincture (benzoin, ℥ij; alcohol, Oj) is much emloyed as a cosmetic, when mixed with water, to remove *freckles* nd slight papular and other *eruptions*, as well as to preserve the eshness and suppleness of the skin. The simple tincture is also sed in the preparation of *court plaster.*

Administration.—Benzoin is seldom administered in *substance*, ut it may be given in doses of from *ten to forty grains.* The dose f the *acid* is about the same. To promote its solution in water, ur parts of phosphate of soda, or one part and a half of borate of oda, may be added.

PIX LIQUIDA.—Tar.

Description.—Tar is the impure turpentine procured by burng from the wood of *Pinus palustris* and other species of Pinus. t is a blackish-brown, tenacious, stringy semi-solid, possessing a rong empyreumatic odor, and a nauseous, acrid, bitter, persistent, nd somewhat acid taste. It is but slightly soluble in water, in hich it sinks, but it readily dissolves in alcohol, ether, and oils. is very inflammable, and in burning emits a dark thick smoke. It consists of resinous matter united with acetic acid, oil of turentine, and various volatile empyreumatic oils, and is colored with harcoal." Among the oils is creasote.

Infusum Picis Liquidæ.—*Infusion of Tar. Tar Water.*

A pint of tar and four pints of water are mixed together, and e mixture frequently shaken during twenty-four hours, the water then poured off and filtered.

Unguentum Picis Liquidæ.—*Tar Ointment.*

This ointment is prepared by stirring together equal parts of tar nd melted suet.

[1] R. W. Ellis, Lancet, Aug. 1856, p. 221.
[2] Mat. Med. d. rein. Pflanzenstoffe, p. 68.
[3] Annuaire de Thérap., 1855, p. 89.

History.—In the Hippocratic writings, tar is spoken of as a dressing for sores, and as a medicine in certain affections of the womb. Pliny[1] describes it as stimulating and healing, and as useful in catarrhs and chronic coughs and various nervous affections when taken internally. Externally, he states that it cures papular eruptions, and the itch of dogs and cattle, heals indolent ulcers, promotes the cure of carbunculous and sloughing sores, of fissures of the anus and of the nipples, and that it is also a remedy for alopecia. Similar virtues are attributed to it by Dioscorides.[2] Other ancient writers, including Galen, repeat the same account.

For a long time this remedy would seem to have fallen into disuse among physicians. Yet it continued to be employed as a popular remedy for man and beast. More than a century ago Bishop Berkeley published his treatise on the wonderful virtues of tar-water,[3] a work in which there is more of all things else than of its nominal theme. The learned writer would seem to have learned something of the popular uses of tar-water during his sojourn in America, but he subsequently attributed to it, as the result of his own observation, all the virtues of a panacea. He alleged it to be stomachic, cardiac, diaphoretic, diuretic, alterative, pectoral, antihysterical, etc., and to be of great use in gout, gangrene, fevers, peripneumonias, pleurisies, erysipelas, scurvy, chronic dysenteries, urinary disorders, and hypochondriasis. To impute such extravagant virtues to any remedy is absurd. In the case of the learned and acute author of the *Minute Philosopher*, it can be explained only by supposing that he craved a faith in something, however preposterous, in order to atone for his denial of what the rest of the world believed. Some eminent names may be found among those who, after Berkeley, attested the value of the remedy; but they singularly curtailed the catalogue of its virtues, and charged it with frequently producing headache and disorders of the digestive organs.

Action.—Small doses of tar are said to display a moderately excitant power, but at the same time to disagree with the stomach, while large ones produce vomiting, purging, pain in the abdomen, and a frequent pulse. A case is reported of a sailor who swallowed between a pint and a quart of "liquid tar." Constant vomiting and extreme debility ensued, with violent pain in the bowels and kidneys, and diarrhœa; but the pulse was not affected, nor was there any pain in the head. The urine was of a bright-red color, and both it and the fæces smelled strongly of tar. Within twenty-four hours the patient recovered, but continued feeble for several days. Fatal cases are reported of poisoning by tar.[4] Tar-water in small doses is said to quicken the pulse and augment the secretion of the skin and kidneys. The vapor of tar, when inhaled, augments the bronchial secretion.

[1] Hist. Nat., xxiv. 23, 24.
[2] Lib. i. cap. xxviii.
[3] SIRIS, A Chain of Philosophical Reflections and Inquiries concerning the Virtues of Tar-Water, etc., 2d ed., 1744.
[4] TAYLOR, On Poisons (Am. ed.), p. 425.

Uses. *In Pulmonary Affections.*—Tar vapors were recommended in 1817 as a remedy for pulmonary consumption by Sir A. Crichton, physician to the Empress of Russia. The late Dr. Morton, of Philadelphia, employed this method in *tubercular consumption*, and found it a palliative of the most harassing symptoms of the disease. In *chronic catarrh* he declared that he knew of no plan of treatment that could compare with it.[1] Whenever the bronchial secretion is excessive, it diminishes this symptom as well as the cough. But as Vogt observed, if too freely employed it produces oppression, pain, hemorrhage, and even disposes to inflammation.[2] Hence, whenever there has been recent inflammation, either primary or intercurrent, it should be avoided, as well as in consumption when hectic fever exists. The manner of employing tar fumes is as follows: In a cup placed in a small water-bath over a common night-lamp, mix some tar with about a twenty-fourth part of its weight of carbonate of potash, in order to neutralize the pyroligneous acid which may be present, and which has an irritating action upon the lungs. The extrication of the vapors should be very slow, but after a few days should be maintained constantly, and their quantity gradually increased. Without this precaution, headache, oppression, and drowsiness are apt to be experienced. Steam, from a vaporizer, charged with tar-water, or with wine of tar, is useful by inhalation, in cases of chronic bronchitis. In the fœtid form of the disease it is peculiarly applicable. *Tar-water* has been found advantageous by Petrequin.[3] In twenty-three cases of pulmonary catarrh and tubercular phthisis, this medicine facilitated expectoration, soothed the cough, diminished the oppression and pain in the chest, while it did not, on the other hand, increase the thirst or derange the digestion. On the contrary, it improved the appetite and diminished existing diarrhœa, and at the same time promoted sleep.

Of other internal uses of this remedy may be mentioned pills of tar in *constipation;* and the use of tar-water by the mouth, and by injection into the bladder, in chronic *vesical catarrh* and in *gleet.*

Diseases of the Skin.—In 1834, Duchesne-Duparc and Dauvergne used an ointment of two drachms of tar to an ounce of lard, in treating *scabies.* It relieved the itching promptly, seldom produced accidental eruptions, and cured the disease within ten days.[4] In the Berlin hospital, Fricke used it successfully in 264 cases, two-thirds of which were cured within a fortnight. But the method was not persevered in because many relapses were observed to follow its employment, and because it involved the destruction of the bed and body clothing used by the patients.[5]

In *scaly eruptions*, and particularly in psoriasis, this remedy was greatly vaunted by Emery,[6] who says: "Before I used this power-

[1] Illustrations of Pulmonary Consumption (1834), p. 135.
[2] Lehrbuch, ii. 171.
[3] Revue Méd., lxiv. 231.
[4] Bull. de Thérap., vi. 144.
[5] STRUMPF, Handbuch, i. 920.
[6] Bull. de Thérap., xi. 216; xiii. 72.

ful method, I never knew, in treating a severe case of psoriasis, whether it would get well, nor when; now I can confidently declare that hardly a case of lichenoid eruption or of psoriasis resists the due application of tar ointment." In support of this statement, Emery claimed more than seven hundred successful cases. He used an ointment containing one part of tar to four of lard, and applied it three times a day. The ordinary duration of the treatment was four or six weeks, but in some severe and inveterate cases it extended to two or three months. It cannot, however, be denied that the permanence of the cure by this treatment appears to be less than when arsenical preparations are employed.[1] The union of both plans is indicated whenever either one singly proves ineffectual.

In some cases of *eczema* of long standing, when all secretion has ceased, and the skin has become thickened, rough, and scaly, tar ointment, or oil of tar, will act more favorably than perhaps all other applications, provided that its strength be cautiously proportioned to the sensibility of the skin. *Herpes circinatus* (ringworm) is often readily cured by tar ointment, as well as by an analogous preparation, the oil formed by condensing the smoke of burning paper. According to Trousseau, tar ointment is one of the most used and useful remedies for *prurigo.*

Tar is used by the vulgar as a dressing for *excoriations* both of man and beast. It is also a popular application to *boils* and to *scorbutic sores.* In *unhealthy ulcers*, says Vogt, tar ointment deserves to be preferred, for it is not easy to accomplish so much with any other dressing. Of late years oakum has become a popular dressing for ulcers, especially in hospitals. It seems best adapted to those which result from burns, which suppurate abundantly, and have large flabby granulations. It corrects the fetor of such sores completely. The oakum, during its application, should not be allowed to become dry, but should be kept slightly moistened with water, and covered with an impermeable tissue. Tar has been used with prompt success to heal mercurial ulcers of the gums and throat, both by painting them with tar itself, and by using a mouth-wash of tar-water. The ancient practice of treating *fissures of the nipples* and *hæmorrhoids* with preparations of tar, has been successfully revived by Jaffé and Marcus.[2]

The deodorizing property of tar renders it an appropriate dressing for *gangrenous sores*, and its emanations may be used for purifying the air of sick chambers.

Administration.—Tar may be given mixed with milk or with beer, or else in pills. From sixty grains to half an ounce may be taken daily. From *half a pint* to a *quart* of tar-water may be taken daily in divided doses.

COPAIBA. Vid. *Diuretics.*
SCILLA. " "

[1] DÉVERGIE, Mal. de la Peau, p. 513.
[2] MÉRAT and DE LENS, Dict., tom. suppl. p. 697.

TEREBINTHINA.	Vid. *General Stimulants.*
AMMONIÆ CARBONAS.	" "
" MURIAS.	" *Alteratives.*
IPECACUANHA.	" *Emetics.*
SULPHUR.	" *Cathartics.*
ASSAFŒTIDA.	" *Antispasmodics.*

DIAPHORETICS.

STRICTLY speaking, *diaphoretics* are medicines which promote the insensible perspiration, and *sudorifics* those which excite sweating. These terms, therefore, only indicate different degrees of the same operation.

The discharge of fluid by evaporation, or in a liquid form, is partly a physical phenomenon, and partly dependent upon vital processes. All moist bodies, whatever, in a relatively dry medium, must give off moisture until a hygrometric equilibrium is established. The human body would soon become so dry that the continued action of its organs, that is, the prolongation of its life, would be impossible but for the due supply of moisture contained in the food and drink, a portion of which is discharged by the kidneys, a portion by the lungs, and a still larger portion, at times, by the skin. Its discharge may be invisible, or the reverse. It is very copious when the condition of the skin, and, perhaps, the state of the fluids, favor its evacuation, and, even under ordinary circumstances, when the air is too moist to carry it away as rapidly as it is formed. But the difference between insensible and sensible perspiration is only one of degree, and is analogous to that between dew and rain, the one of which is visible and the other invisible in the atmosphere only because the latter is in a more condensed and the former in a more rarefied condition.

It is probable that perspiration produced by debility consists of little else than water, while that of health is formed by water holding in solution a large proportion of salts, and more or less of the products of textural disorganization. It is alleged by Schultz[1] that the effete elements of the muscular system are eliminated chiefly through the skin; but, considering the close relationships of the skin and kidneys, manifested by the fact that unusual activity in the one involves a diminished activity in the other emunctory, and the morbid effects which result from the suppression of the cutaneous exhalation, it may be considered certain that the skin is a principal outlet of effete matters derived from various and probably many organs, and which become causes of disease when retained in the blood. Of this fact, indeed, there is the direct evidence of

[1] Allgemeine Pharmakologie, p. 233.

the senses, when, in disease, the perspiration acquires sour or fetid odors, when we observe it to exhale the smell of garlic, musk, amber, assafœtida, etc., and when we see that it becomes glutinous or greasy, and that occasionally even its color is altered to yellow, blue, red, green, etc. These facts suggest a partial explanation of the circumstances that all perspirations are far from having the same influence upon disease; and that while some coincide with a marked amelioration of the symptoms, others exert no influence upon its course, or appear only to aggravate it by inducing debility.

The influence of perspiration upon the temperature of the body is one of its most important modes of action. It is by this, indeed, that the animal heat is maintained constantly at very nearly the same degree; for the more active does the generation of caloric become, the more copiously is this principle evolved from the cutaneous surface, carrying with it a large proportion of moisture. But in febrile diseases, while the temperature of the body is raised by the activity of the destructive processes going on in the economy, the cutaneous exhalation is diminished, according to the old expression, which modern science has done so much to justify, by "a spasm of the capillary vessels of the skin," and the sensation of heat in this tissue, as well as in the internal organs, becomes a source of much suffering. A subsidence of the excitement and tension is usually accompanied with more or less perspiration. The occurrence of such a discharge has generally been looked upon as the cause of the relief which is then experienced. But although the elimination of morbid matter which probably takes place through the skin, and visibly by the urine at the same time, may tend to bring the febrile attack to a termination, it cannot be overlooked that the very occurrence of diaphoresis demonstrates that some salutary change within the economy has preceded it, and that this change, therefore, and not the perspiration itself, is the true cause of the amelioration of the symptoms. The amount of the exhalation from the skin is not proportioned to the relief which accompanies it, and, indeed, in several febrile diseases, bears to it an inverse proportion. In typhus fever, articular rheumatism, and hectic fever, for example, the discharge of liquid from the skin is frequently profuse, and yet, far from alleviating the febrile symptoms, it only renders them less tolerable. It may be suggested that in these and similar cases, the liquid which is poured out by the skin so copiously, contains none of the morbid elements which sustain the disease. This may be perhaps admitted as a general proposition; and yet we observe that in rheumatism the secretion is continuously and strongly acid, without at all alleviating the suffering of which, in the opinion of many, acidity is a cause. When, therefore, the symptoms of a febrile disease subside during the occurrence of diaphoresis, we may presume that the two phenomena are effects of a common cause, and that either they precede the other in the order of their appearance, or take place independently.

It is not uninteresting to observe that the ancient physicians fully recognized the truth of the principle which we are now en-

deavoring to inculcate, that the mere act of sweating is not necessarily of advantage in disease. Upon this point Hippocrates expressed himself very emphatically, declaring that those sweats alone are beneficial which take place over the whole body, and are followed by an alleviation of the symptoms, a doctrine which amounts nearly to an admission that, in themselves considered, they are of little value. He even went further, and restricted his favorable opinion of sweats to those which occur upon critical days; but since the very determination of these days depended, in some degree, upon their being marked by the occurrence of sweats, and the simultaneous subsidence of the symptoms, it is evident that his doctrine was implicitly an admission that some perspirations are signs of a favorable change in disease, and that others are not.

It does not at all follow from these doctrines, that medicines which tend to promote perspiration ought not to be administered for the cure of disease. In so far as experience has pronounced in their favor, they should be employed, whatever view we may think proper to take of their mode of action; but a moment's reflection will render it plain that they may excite diaphoresis independently of any power which they exert directly upon the skin, by merely neutralizing, counteracting, or removing conditions which impede the powers of the system in their natural tendency to produce this effect. A consideration of the various influences which occasion diaphoresis will render plain that it is quite as often the consequence of an indirect as of a direct operation upon the skin.

If we inquire into the nature of the causes which produce or promote perspiration in health, we shall find that they are almost without exception stimulants. Heat is the most universal in its influence, and is applied in the greatest variety of forms, including he solar rays, combustion, the use of food and of spirituous or simly hot drinks, of clothing made of imperfect conductors of caloric, nd which merely prevents the loss of heat previously generated the body, muscular exercise which hastens the development of nimal heat, and friction or other modes of mechanical stimulus hich act in the same manner. All of these agents may be emoyed as diaphoretics in diseases to which they are applicable. heir effect is evidently to augment the quantity of blood in the ssels of the skin, either by quickening the central organ of the culation, as in the case of alcoholic drinks, or by stimulating the n itself, and thus attracting towards it a larger amount of blood n usual. These movements, when excited in health, generally e in the production of diaphoresis. The skin is naturally perable, and the various stimuli merely augment, in a greater or degree, its natural function, rendering visible in a liquid form moisture which was before invisibly exhaled.

ut in disease the conditions are different. The most ordinary is fever, in which one of the most familiar phenomena is dryof the skin. This is evidently accompanied with turgor and ss, showing that although the quantity of blood in the tissue reased, its secreting and exhaling powers are diminished. It

may not be easy to explain why this should be, or to decide whether it is owing to a mechanical distension of the capillaries which paralyzes their movements, or whether there is really a spasmodic contraction of those unstriped fibres in which the skin abounds, and which thus prevents the exit of fluids from the bloodvessels. The former of these suppositions, as an exclusive explanation, is the more probable of the two; for were it true that the contractile element of the skin was in a state of spasm merely, the tissue ought to be comparatively pale, as we see that the scrotum is when the dartos muscle is corrugated. The skin being, on the contrary, more highly colored than natural, we must in this case adopt rather the alternative supposition. It is also more in harmony with the observed effects of diaphoretic medicines. In febrile affections with a dry skin, perspiration may be produced by stimulant or by sedative diaphoretics, but not by either indifferently. The propriety of a choice between them will depend in a great measure upon the stage of the disease. While it is still in embryo, as it were, and before its material elements have acquired the fixity of a new form, they may be dispersed by the application to them of a sudden and lively force. Thus it is that at the commencement of fevers and inflammations a stimulant diaphoretic not unfrequently prevents the further development of the attack, scattering their gathered elements, and eliminating them with the perspiration. But when once the vascular engorgement has exceeded that limit beyond which the vessels refuse to contract under the action of such stimulants, and possibly are thrown into a spasmodic state, it is evident that stimulant medicines must only tend to aggravate the mischief, and, so to speak, impact the blood more firmly in the capillary vessels. Sedatives of the nervous and circulatory system, upon the other hand, must tend to promote diaphoresis—first, and possibly, by relaxing the supposed spasm of the vessels or of the skin; but secondly and more certainly by lowering the action of the heart and arteries, allowing the blood to retreat from the capillaries, and consequently permitting its more fluid parts to escape as perspiration. Thus, according to the condition of the skin and of the system in general, a stimulant or a sedative may be the most appropriate agent for the production of diaphoresis. In the one case the circulation must be excited in order to cause the bloodvessels to discharge their more liquid contents through the pores of the skin; in the other it must be depressed, in order to render the escape of fluid possible from the engorged bloodvessels. Familiar illustrations of the former have already been referred to in the various dietetic and calorific agents, including hot drinks; of which it may be further remarked, that the rapid accession of a large quantity of liquid to the bloodvessels, by absorption from the stomach, must tend to excite diaphoresis whenever the general temperature of the body does not greatly exceed its normal average, even independently of the caloric with which it is combined; but its union with heat gives it a special direction to the skin when it would otherwise tend to escape by the bowels or by the kidneys.

When, on the other hand, the skin is abnormally hot and dry, it is more quickly rendered perspirable by draughts of cold than of warm liquids. This fact is familiarly illustrated during the intense heats of summer, when the skin is dry and burning, by the immediate and often profuse perspiration which a copious draught of cold water seems to force from the body; and in febrile diseases, by the effect of cold water applied by sponging or by affusion. It should, then, be borne in mind that what Alexander was the first to describe as "the sweating point"[1] is a reality, "and that the further the heat of any person is advanced above or reduced below this standard, the further is he removed from any possibility of sweating." This point, however, is not a fixed temperature; it varies with every person even in health, and still more in disease, but, in general, bears a direct proportion to the temperature of the skin.

These considerations justify and explain the division of diaphoretics, which is sometimes made, into stimulants and sedatives. The first are chiefly applicable to febrile diseases in their forming stage, and to chronic affections in which a mild but sustained operation promotes the elimination of morbid materials from the system. The second are most frequently employed at the height of febrile diseases, or at the commencement of those which might display a dangerous nature if treated unavailingly by stimulants. Stimulant diaphoretics comprise, besides heat and moisture, and the reaction from cold suddenly applied to the skin, alcoholic preparations, and a large number of vegetable substances containing an acrid principle, and which are generally administered in hot decoction or infusion, or in mixtures. Sedative diaphoretics include a great number of agents, belonging to different classes of the materia medica, but chiefly to that of emetics and saline purgatives. Of the former some appear to operate by their nauseating or emetic action alone, and others, as tartar emetic, by a direct sedative influence upon the nervous system, and, through it, upon the circulation and its dependent functions. By the latter a diaphoretic action is exerted independently of any operation upon the bowels, and is indeed quite inconsistent with this occurrence. That they are absorbed into the blood is unquestionable, and that they induce diaphoresis by a sedative action upon the circulation is probable; but whether this is accomplished dynamically, or by a chemical or physical dilution of the blood, is not determined. Some of these medicines, as the salts of potassa and soda, especially those formed with vegetable acids, appear to have no stimulant influence at all, and therefore to be most appropriately used in purely sthenic diseases. But others, like the salts of ammonia, and especially the acetate in solution, are unequivocally diaphoretic, although compounded of a stimulant and a sedative. Indeed, the most efficient of all sudorifics appear to combine these two qualities. This peculiarity is very striking in Dover's powder,

[1] Essays, p. 165.

which is composed of opium and ipecacuanha, in the former of which a stimulant, and in the latter a sedative virtue prevails. Nor is it hardly less so in opium itself, whose stimulant properties, in certain doses of the drug, are as palpable as its sedative operation in larger ones. Yet even in the latter a distinctly stimulant influence is perceptible, followed, however, by sedative and profuse perspiration. Indeed, the more the action of this group of powerful diaphoretics is examined, the more probable does it appear that their peculiar effects are due to their producing successively, but in close succession, stimulation and sedation.

The therapeutical management of diaphoretics requires a great deal of circumspection. It may be held to be a law, to the application of which there are very few exceptions indeed, that powerful and stimulant sudorifices are useful only in the forming stage of acute febrile diseases. All of those which originate in the impression of cold upon the surface of the body, affections of the throat, lungs, and skin, especially, and even of the bowels, may generally be arrested in their development by almost any agency which will excite a copious discharge of perspiration; by hot stimulating vegetable infusions, for example, in the case of the first-mentioned disorders, and by opium, or, still better, by Dover's powder, in these, and more particularly in the last. Nor is such an impression upon the economy much less efficient in the forming stage of miasmatic fevers, for it often prevents the further progress of the disease, especially if conjoined with the use of an emetic, and followed by a full dose of opium. It is this striking and salutary result of the treatment that has lent a powerful support to the doctrine that it becomes curative by eliminating a morbid poison derived either from the suppressed perspiration or received into the system through the lungs. A similar remark applies to many cases of uræmia, cholæmia, poisoning by venomous animals, and by mineral poisons, especially lead; although it must be admitted that, except in the third of these examples, diuretic medicines are more efficient than diaphoretics.

In certain chronic diseases, such as rheumatism, gout, Bright's disease, skin diseases, syphilis, scrofula, etc., the energetic appliances of the water-cure are sometimes attended with remarkable success, when they have produced copious diaphoresis, and the body is, as it were, purged through the skin by the simultaneous administration of cold water.

It was an ancient practice to attempt the cure of dropsy by covering the patient with hot sand, and the same method has been employed in our own time for the relief or cure of anasarca. A more convenient, and probably a more efficient plan, consists in surrounding the patient with hot air received under the bed-clothes through a tube connected with a funnel inverted over burning alcohol. The unusual dryness of the skin in diabetes no doubt suggested a similar method of treating that affection, and of using opium, which, while it promotes the action of the skin, restrains

that of the kidneys. The advantages of this method have already been discussed in the article on Heat.

But if the utility of diaphoretic medicines is unquestionable in many chronic diseases and at the commencement of the greater number of acute affections, their application to fully-developed febrile disorders, whether idiopathic or symptomatic, is subjected to different rules. These affections, when once formed, involve a more or less radical change in the condition of the nutritive functions, which, as it has required time for development, requires it also for a cure. Of all the benefits conferred upon medicine by morbid anatomy, none exceeds in value its demonstration that the greater number of diseases are associated with, and often dependent upon, physical changes, changes of bulk, consistence, composition, etc., in the affected parts, and, consequently, that any treatment which claims to effect their immediate restoration may justly be accused of false pretences. Hence it is easy to understand why the more active agents of the present class must be altogether rejected from the treatment of affections such as those referred to, in common, it may be added, with perturbative treatment of every kind. The ancients, without being aware of this reason, which to the modern pathologist is so conclusive, were none the less taught by experience the danger of using stimulant diaphoretics during the height of inflammatory diseases. Dr. Freind, indeed, declares that Hippocrates *always* mentions sweat as a prognostic only, and not as a means of cure, and that, in the genuine works of this physician, allusion is never once made to any remedy which might provoke sweat; it is added, moreover, that even in Galen's works no reference is made to any internal medicine for this purpose.[1] So Celsus speaks of using diaphoretics only when a tendency to perspire is manifest,[2] and elsewhere of forcing a sweat, but only with cold water.[3] The practice of employing alexipharmics and other stimulants as diaphoretics belonged originally to some of the Arabian school and their successors, but the most judicious physicians of modern times, who have bequeathed to us the precious legacy of their experience rather than ingenious hypotheses, are almost unanimous in condemning this class of medicines in febrile affections. In this, Sydenham and Hoffmann, so widely different in many other respects, were perfectly agreed.

The only diaphoretics which are adapted to the cure of such disorders are those which either by nature or by reason of the smallness of their dose incur no risk of aggravating the symptoms they are intended to relieve. Such are the nauseants, as tartar emetic and ipecacuanha, or the mild and transient stimulants, as the ethereal preparations. If, however, an inflammatory disease assumes a typhoid type, stimulants may be resorted to, not because they excite diaphoresis, but, on the contrary, because this operation is of secondary importance when compared with direct stimulation in

[1] Nine Commentaries upon Fevers, p. 35.
[2] Book iii. ch. vi.
[3] Ibid., ch. vii.

such cases, and because, further, in the relaxed condition of the skin which then exists, stimulant diaphoretics (diffusible and opiate) tend rather to check than to promote perspiration.

LIQUOR AMMONII ACETATIS.—SOLUTION OF ACETATE OF AMMONIUM; SPIRIT OF MINDERERUS.

History.—It is generally stated that a solution of acetate of ammonium was first described, in 1732, by Boerhaave, who introduced it into the materia medica.[1] It was, however, first discovered by Raymond Minderer, of Augsburg, in 1621.[2]

Preparation and Properties.—This solution is prepared by saturating diluted acetic acid with carbonate of ammonium. It is a colorless, transparent, and inodorous liquid, of a sweetish saline taste, and readily decomposes by keeping. It has a sp. gr. of 1.011, and is, therefore, less concentrated than the French and German preparations, the former of which has a sp. gr. of 1.036, and the latter of 1.035, and contains fifteen per cent. of the pure acetate, and also acts sensibly upon the living tissues, dissolving the cuticle and the epithelium of the gastro-intestinal mucous membrane. The solid crystallized acetate of ammonium may be obtained by evaporating the saturated solution in an air-pump over sulphuric acid. This salt readily deliquesces.

Action. *On Animals.*—Mitscherlich[3] injected into the stomach of a rabbit half an ounce of the solution (*Pharm. Bor.*). It occasioned no decided symptoms. But when an ounce was used great prostration ensued, hurried breathing, frequent pulse, inability to stand up, with alternate rigidity and spasms, and death within two hours; no fæcal discharge took place; the epithelium of the stomach and small intestine was found dissolved. In another experiment, half an ounce of the solution was twice injected into the cellular tissue of the abdominal walls of a rabbit. The animal uttered loud cries and struggled, then grew feeble, and lay first upon the belly and then upon the side; spasms and tetanus followed, and death took place in an hour and ten minutes. On inspection, the wound was found to be full of bloody serum, and the bloodvessels around were distended with slightly coagulated blood. The epithelium of the upper portion of the intestine appeared to be thinned and covered with more mucus than usual. These experiments show that the preparation is far from being inoperative.

On Man.—Cullen put forth the singular opinion that this medicine is valueless. He had "never seen any benefit from it," and had "known four ounces taken at once, and soon after four ounces more, without any sensible effect."[4] Many other writers make an opposite statement. Voigtel says that it acts as a general but mild

[1] PEREIRA.
[2] STRUMPF, op. cit., i. 869.
[3] Lehrbuch, ii. 294.
[4] Mat. Med., ii. 347.

and transient stimulant, with a special direction to the skin and kidneys.[1] Richter found it to be most valuable for its diaphoretic properties. He states that it renders the pulse somewhat fuller and more frequent, and augments the general activity and warmth of the skin, until sweat breaks out, when these symptoms decline, and coolness and relaxation succeed. He adds that, when it does not act upon the skin, it augments the secretion of the lungs and the kidneys. In large and repeated doses it disturbs the digestion, and provokes diarrhœa.[2] According to Mérat and De Lens, its stimulant properties are incontestable.[3] Patin found that it produced a transient giddiness and intoxication.[4]

The preceding conclusions were drawn from observing the action of the remedy in disease. They do not agree with the results of experiments on healthy persons. Thus, Wibmer observed no effects in his own person except some irritation of the fauces, a little warmth in the abdomen or skin, with headache and loss of appetite for several days. The negative results of Cullen and the inconsiderable effects observed by Wibmer do not, however, neutralize the statements that positive phenomena follow the use of this medicine in disease. Either may be true, or both; and both, we are persuaded, are so.

Externally, according to Mitscherlich, the solution acts as an irritant to the skin, inflaming and vesicating it. It is more active than the muriate, but less so than the carbonate of ammonium.

Uses.—It is a useful remedy in those slight cases of fever produced by the suppression of perspiration by cold; but if actual inflammation sets in, it is of little use, if not of absolute injury. Hence, it may be prescribed in mild cases of *catarrh*, *sorethroat*, and *muscular rheumatism*, or in more sthenic cases after the fever has begun to decline. In *scarlatina* and *measles* it is much esteemed by several authors of repute when the eruption develops itself slowly or imperfectly, and again after the fever has subsided, leaving the nervous system irritable and impressionable. Vaidy found it very useful in an epidemic of *pseudo-membranous broncho-pneumonia*, in which the antiphlogistic method signally failed.[5] Michel, Mazuyer, Vaidy, and others, were equally successful in the use of it in *typhoid fever*. In the adynamic forms of that disease, and in *petechial typhus*, we have frequently prescribed this medicine, and believe it to mitigate the heat of skin, to moderate the delirium, and diminish the dryness of the tongue. It is the best diaphoretic that can be used in epidemic catarrh, or *influenza*.

Few remedies are so successful as a teaspoonful or two of this solution, in *sick headache*. In *alcoholic intoxication* Mazuyer affirms that it speedily puts an end to the phenomena of drunkenness, and is not so unpleasant as aqua ammonii. A teaspoonful or two is sufficient; if this is vomited, a second dose should be given

[1] Arzneimittellehre, iv. 527.
[2] Ausfürl. Arzneim., iv. 337.
[3] Mat. Med., i. 243.
[4] Archives Gén., xviii. 231.
[5] Annales de Thérap., v. 91.

within five minutes afterwards.[1] Ogston and Chevalier testify to the same purpose.[2]

In 1817 Voigtel recommended this medicine in *dysmenorrhœa*, saying that it may render more powerful and active remedies unnecessary.[3] In 1828 Patin referred to a case in which Cloquet administered it with success to relieve severe uterine colic attending menstruation; he himself obtained a like result, but observed that the catamenial discharge was at the same time diminished. He claims to have employed it with remarkable advantage in *menorrhagia*, even when depending upon organic disease of the uterus. He concludes that whenever there is a fluxionary movement towards the pelvic organs, from whatever cause, this remedy will palliate the pain, hemorrhage, etc.[4] The observations of Carrière[5] fully sustain this conclusion, although he attributes the phenomena observed to an antispasmodic rather than to a purely stimulant action. Others, again, have referred them to a sedative action upon the vascular system.[6] Such considerations are of slight importance, provided that the fact be settled of the medicine's utility in any form of dysmenorrhœa. That it is so may be considered probable.

Various writers have recommended the spirit of mindererus in *dropsy* depending upon atony of the skin and kidneys, and in particular in the form which occurs after scarlatina and measles. Dr. Todd also has advised it in "inflammatory dropsy."

In many other diseases acetate of ammonium has been alleged to be serviceable, *e. g.*, *epilepsy*, *hydrophobia*, *whooping-cough*, *asthma*, *uterine cancer*, *chronic eruptions of the skin*, *scrofula*, *jaundice*, etc., but the evidence of its utility in these affections is very slight, if not altogether illusory.

Externally this remedy is of great service as a discutient in *bruises*, *lacteal engorgements*, *glandular swellings*, *commencing abscesses*, *dropsy of the joints*, and even in *hydrocele*. Dr. A. T. Thomson[7] recommends it as a collyrium, with opium, in chronic *ophthalmia*, and, when diluted, as an injection in *gonorrhœa*. In *porrigo of the scalp*, he says, "I have ordered it with the best effect as a lotion."

Administration.—The dose of the officinal solution is from *half a fluidounce* to *a fluidounce and a half*, mixed with water and sweetened with sugar. But it is to be remarked that nearly all of the effects which have been attributed to the solution, by the writers referred to above, were obtained from the stronger preparations of the German and French Pharmacopœias. Of the German solution, the prescribed dose is *one or two fluidrachms* every two or three hours. This medicine is often associated with spirit of nitric ether, and with tartar emetic.

[1] Bull. des Sci. Méd., 1825. [2] CLARUS, Arzneim., p. 787.
[3] Arzneimittel., iv. 528.
[4] MÉRAT and DE LENS, Dict. de Mat. Méd., i. 244.
[5] Annales de Méd. Psychol., vii. 204. [6] Annales de Thérapeutique, iv. 129.
[7] Dispensatory, p. 886.

LIQUOR POTASSII CITRATIS.—Solution of Citrate of Potassium.

Preparation.—Under the names of *neutral mixture* and *effervescing draught* two forms of this useful medicine are employed. The former is prepared by saturating any quantity of bicarbonate of potassium with a solution of citric acid, or lemon-juice; or by directly dissolving three hundred and thirty grains of bicarbonate of potassium and half a troyounce of citric acid in half a pint of water. The latter is often prepared extemporaneously by adding "to a fluidounce of a solution consisting of equal parts of lemon-juice and water half a fluidounce of a solution containing fifteen grains of carbonate of potassium, or twenty grains of the bicarbonate." When lemon-juice cannot be obtained, a solution of citric acid, of the strength just mentioned, may be used as a substitute, but it is far less palatable.

These preparations constitute the *fever draughts* which are universally employed in England and in this country for inflammatory affections, and in the hot stage of paroxysmal fevers. The effervescing draught is usually most grateful to the patient, and is particularly useful when there is much nausea and thirst, both of which symptoms it frequently allays with promptness, while it lowers the pulse and the heat of skin, and induces perspiration, as well as promotes the secretion of the kidneys. There is no better mode of correcting undue *acidity of the urine* than to administer this or the other vegetable acids. When taken into the stomach the citrate is decomposed during digestion, and a carbonate is excreted by the kidneys, rendering the urine alkaline. In febrile affections the solution may be improved by the addition of sweet spirit of nitre or of tartar emetic. In all cases when it tends to disorder the bowels a small proportion of laudanum or sulphate of morphia may be added.

Administration.—Of the *neutral mixture one or two tablespoonfuls* somewhat diluted, may be given every two or three hours, or oftener. The dose of the effervescing mixture is *two tablespoonfuls* of the acid solution with fifteen grains of the carbonate (which is preferable), or twenty grains of the bicarbonate of potassium, repeated at the same intervals as those recommended for the neutral mixture.

SPIRITUS ÆTHERIS NITROSI.—Spirit of Nitrous Ether; Sweet Spirit of Nitre.

History and Description.—This is one of the numerous compounds for which we are indebted to the former chemical school of medicine. Its discovery is generally attributed to Basil Valentine, in the fifteenth century. It is prepared, first by the action of sul-

phuric acid upon alcohol, by which sulphuric ether is produced; then by the simultaneous action of nitric acid upon copper, which generates nitrous acid; the nitrous acid and the sulphuric ether, by their mutual reaction, form nitrous ether, which is then mixed with alcohol.

Spirit of nitrous ether is a transparent and volatile liquid, of a pale yellow color, with a shade of green, a sharp, burning taste, and a peculiar aromatic and ethereal fragrance. It has a slightly acid reaction, which is increased by age, and a sp. gr. of 0.837. It mixes readily with water and alcohol, and is very inflammable.

Action. *On Animals.*—The vapor of this preparation is a deadly narcotic poison. Breathed by rabbits and cats, it speedily brings on spasms, and death in one or two minutes, after which the blood of the animals is found liquid, watery, and of a chocolate color, the membranes of the brain and the lungs are injected, but the bronchial mucous membrane is not inflamed.[1]

On Man.—In moderate doses, sweet spirit of nitre produces an increased secretion by the kidneys, if the skin is kept cool, and by the skin itself if its warmth is preserved; at the same time it acts more or less as a diffusible stimulant, but so gently as not to produce decided heat of the surface. When this part of the system is already in a febrile condition, the nitre tends to reduce its temperature, and at the same time to promote perspiration. Often, indeed, the occurrence of sensible moisture upon the skin precedes its coolness. It is to this secondary operation, rather than to the free acid contained in the preparation, that its refrigerant action must, we think, be ascribed. It is true that, as too often sold, there is a large proportion of free acid in the liquid, but it is also then that its sedative action is least distinct. It is to this acid that must be attributed certain poisonous effects observed by Kraus[2] in a boy twelve years of age, who had taken a drachm of the spirit. For six hours he suffered from colic, and had copious slimy evacuations. When inhaled, its toxical effects are very decided. Hermbstadt experienced headache, throbbing of the temporal arteries, anxiety, and giddiness.[3] Other experimenters, or observers, have described a cyanotic condition, giddiness, confusion of mind, a small, thready pulse, with loss of muscular power, and spasms, lasting from twelve to eighteen hours.[4] It is related that a druggist's female servant was found dead in her bed, apparently poisoned by the fumes of the "spirit of nitric ether," a large bottle or jar of which was broken in her room.[5] She lay on her side, with her arms folded, the countenance and posture composed, and the whole appearance that of a person in deep sleep.

Uses.—This medicine is most frequently used in *febrile affections*, with a view of allaying *nausea*, *heat of the skin*, and *arterial* or *nervous excitement*. Under these circumstances it may be associ-

[1] MITSCHERLICH, Handbuch, ii. 364.
[2] Ibid., ii. p. 363.
[3] STRUMPF, Handbuch, i. 1014.
[4] MITSCHERLICH, loc. cit.
[5] Edin. Med. and Surg. Journ., xxxv. 452.

ated with the neutral or the effervescing mixture, the spirit of mindererus, or a solution of tartar emetic. In idiopathic *dropsy*, and particularly in that form of it which arises from cold, or as one of the sequelæ of scarlatina, it sometimes proves sufficient to remove the effusion, but more frequently it must be associated with squill, acetate of potassa, or digitalis. In *dysury* from *cantharides*, or from a too concentrated state of the urine, it generally affords relief. It is an agreeable and efficient carminative when flatulence is connected with sickness at the stomach. *Externally* it may be prescribed as a cooling evaporating lotion in *neuralgic headache*, but if long continued its acid irritates the skin. It has also been employed as an application to certain *scirrhous ulcers* of the lip supposed to be cancerous, in which case, according to Richter, its free acid is the curative agent.

Dr. Bowditch and Dr. Rickard have employed *inhalations* of the vapor of sweet spirit of nitre as a palliative of *cough* in acute and chronic inflammations of the pharynx and larynx.[1]

Administration.—It is usually directed in doses of from *half a fluidrachm* to *two fluidrachms*, in some diluent vehicle, and still larger quantities are advised in dropsy. These may be needful to obtain its diuretic operation, but in febrile affections its diaphoretic influence may be secured by much smaller doses, such as *twenty or thirty drops* repeated every hour or two.

PULVIS IPECACUANHÆ COMPOSITUS.—Compound Powder of Ipecacuanha; Dover's Powder.

Description and History.—The compound powder of ipecacuanha is made by triturating together one part each of opium and ipecacuanha with eight parts of sulphate of potassa.

For this useful and admirable compound we are indebted to Dr. Dover, who employed it as a sudorific in gout.[2] His mode of preparing it differed from the present officinal one, in that the medium for uniting the opium and ipecacuanha consisted of nitrate and of sulphate of potassa fused together. The mixture was also diluted with powdered liquorice-root. He prescribed from forty to sixty or seventy grains in a glass of wine posset at bedtime, and directed that the patient should be warmly covered, and drink two or three pints of the liquid while sweating. He affirms that in two or three hours the gouty pain will quite have vanished. The minimum dose mentioned by him contains nearly four grains of opium!

Action.—The essential virtues of this medicine depend upon the opium it contains; but the ipecacuanha would appear to render the diaphoretic effects of its associate more decided, and at the same time to diminish its narcotic operation. On the other hand, it has the disadvantage, as compared with opium, of more readily exciting

[1] Boston Med. and Surg. Journ., Dec. 1858, p. 381.
[2] The Ancient Physician's Legacy to his Country (1742), 6th ed., p. 14.

nausea and vomiting. An instance is recorded in which fatal narcotism in an adult is alleged to have been produced by a dose of between fifteen and twenty grains of Dover's powder.[1]

Uses.—This preparation is employed whenever it is desired to obtain a sudorific as well as a narcotic and anodyne effect. Hence it is most frequently prescribed in *rheumatism*, and most beneficially in the muscular forms of the disease, or in cases affecting the joints which are originally mild, or have been partially subdued by an antiphlogistic treatment. In such cases the free and repeated use of this remedy often serves to arrest the progress of the attack. In the forming stage of *other inflammations*, such as pleurisy, pneumonia, bronchitis, enteritis, dysentery, orchitis, etc., it is sometimes equally efficient in preventing the development of the disease, when given in full doses. If it fail in this, it may still do much to mitigate the severity of the symptoms. It is said to be very serviceable in *hemorrhage* from the internal organs, and particularly from the *uterus*. This statement appears to be probable as regards cases which are distinguished by a cool and contracted state of the integuments. The colliquative *sweats* of phthisis are sometimes quite controlled by seven or eight grains of Dover's powder given in two pills at bedtime.

Administration.—The full dose of Dover's powder intended to produce diaphoresis is *fifteen or twenty grains;* but *ten* grains are more usually prescribed, containing of opium and ipecacuanha each one grain. The latter dose may be conveniently given in three pills. Within an hour afterwards, hot and somewhat stimulant drinks may be administered. A less degree of diaphoretic influence may be maintained by doses of from three to six grains every two or three hours.

GUAIACI LIGNUM.—GUAIACUM WOOD. GUAIACI RESINA.—GUAIAC.

Description.—A peculiar resin obtained from *Guaiacum officinale*, by spontaneous exudation, by incision, by dry heat, or by decoction of the comminuted wood. This is a tree from thirty to sixty feet in height, and is a native of the Antilles, particularly of Hayti and Jamaica. The bark is medicinal as well as the parts mentioned. The wood is the well-known *lignum vitæ*, and is remarkable for its density. Owing to this quality, it is employed for many mechanical purposes. Its raspings and shavings are used by the druggists. When subjected to friction, or burned, it exhales an aromatic perfume. It has a bitterish and acrid taste. It contains twenty-six per cent. of resin, and a fractional proportion of a peculiar bitter and acrid extractive matter. A volatilizable acid is also extracted from it called the *guaiacic*, which has a close affinity to the benzoic, and is, indeed, thought by some to be identical with

[1] Med. Times and Gaz., Feb. 1855, p. 133.

the latter; but it differs in being soluble by water, alcohol, and ether. The resin is the concrete juice of the guaiacum tree. It is of a greenish-brown or reddish color, whenever it is exposed to the air. Internally, it is rather of a reddish-brown color, and presents a shining conchoidal fracture. After having been chewed a little while, its taste is acrid and pungent, and it emits, when thrown on coals, a strong but grateful and aromatic smell. This resin is soluble in ether, alcohol, and alkaline solutions. The last-named quality has caused it to be regarded as an acid.

The following are officinal preparations of guaiac:—

TINCTURA GUAIACI.—*Tincture of Guaiac.*

It is obtained by percolation from six troyounces of coarsely-powdered guaiac with sufficient alcohol to produce two pints of tincture. Dose, from one to four fluidrachms two or three times a day.

TINCTURA GUAIACI AMMONIATA.—*Ammoniated Tincture of Guaiac.*

This preparation is made by macerating six troyounces of powdered guaiac in two pints of aromatic spirit of ammonia and filtering the solution. Dose, one or two fluidrachms. Both tinctures may be conveniently administered in milk, mucilage of gum, barley-water, or gruel.

Guaiacum also enters into the compound decoction and the compound syrup of sarsaparilla.

History.—In the first expedition to America, several Spaniards affected with syphilis were cured of it by the natives with a decoction of guaiac.[1] In 1508, the wood was carried from Hispaniola to Spain, and became known in Europe chiefly by the treatise on its effects in syphilis by Ulric von Hutten, in 1519.[2] This soldier was himself cured by its means of constitutional syphilis, under which he had labored for nine years, and after having undergone eleven courses of mercurial treatment in vain.[3] In the same year, one Nicholas Poll published an account of the cure of three thousand cases by this medicine.[4] Nevertheless, it did not sustain its original vogue, either in consequence of its acting less favorably in the cooler climate of Europe, or because the due employment of it was irksome, or finally because the superior success of mercury eclipsed its reputation.

Action.—The effect produced upon the organs of taste has already been noticed, and has been ascribed to the volatile and extrac-

[1] LANE, Lancet, Dec. 1841, p. 303. [2] VOIGTEL, Arzneimittellehre, i. 117.

[3] Fracastorius thus describes the operation and results of the treatment by guaiacum:—

> "Imponunt sese stratis, medicamen ut intro
> Large est, et calido sudorem e corpore ducat.
> Interea vacuas pestis vanescit in auras:
> Et (dictu mirum) apparet jam pustula nulla:
> Jam nomæ cessere omnes, jam fortia liquit
> Membra dolor, primoque redit cum flore juventa."
>
> *Syphilis*, lib. iii. vers. 84.

[4] STRUMPF, Handbuch, ii. 342.

tive matters of the wood and resin, for, as Schwilgué remarked,[1] the pure resin produces no sensible effects upon the economy, whereas, the decoction of the wood, which contains no resin, represents all the medicinal virtues of the drug. Guaiacum mainly influences the vascular system, promoting the cutaneous exhalation. Some experiments of M. Sandras[2] tend, in his opinion, to throw much doubt upon the sudorific qualities of this medicine because he did not observe them unless his patients were placed in circumstances favorable to transpiration. But the objection is not valid; it might be brought with equal justice against all diaphoretics whatever. In some cases it has been observed to produce only general lassitude and dulness. In others, according to Kraus, it sometimes occasions an exanthematous eruption. When the system is impressionable, it causes vascular fulness, and a proneness to congestion and inflammation, and when used for some time it deranges the digestion. In excessive doses, it causes burning pain in the throat and stomach, vomiting, purging, palpitation of the heart, disordered circulation, congestion of the head, confusion of the mind, giddiness, fainting, etc.

Uses.—If we look at the early accounts given of its successful employment in *syphilis*, the narrative of v. Hutten, for example, we observe that the patient was obliged to undergo a regimen of the strictest kind, to drink enormous quantities of a stronger and of a weaker decoction of the wood, to live upon a very sparing and simple diet, and in every manner to promote perspiration. A similar regimen was insisted upon by Boerhaave, Valsalva, and Morgagni. It cannot be wondered at, therefore, that the insignificant doses of the medicine and its unmethodical administration, which are now usual, should fail entirely of producing its appropriate effects. Still, the experience of the present time proves that the decoction of guaiacum is really of service in constitutional syphilis of long standing, which affects the bones and skin, and is complicated with the evil results of a long mercurial course, especially in persons of a scrofulous, feeble, or impaired constitution.

At one time, a tincture of guaiac had much reputation in *gout*. It was advised by Cullen in the chronic forms of this disease. He directed from fifteen to thirty grains in an emulsion to be taken at night, so as to produce a cathartic operation. Quarin, Stoll, P. Frank, and others, recommended it under the same circumstances, but Chapman, on the contrary, thought it useful in the irregular forms of the disease, as when it threatens the stomach, etc.

Dr. Dewees first employed this remedy in idiopathic *suppression of the menses*, and placed great confidence in its efficacy.[3] But he considered depletion, purging, and low diet, essential preliminaries to its exhibition, and alleged that when thus employed, it never failed in any case proper for its use. Indeed, he held it to be "more certain than bark in an intermittent." Dr. Dewees used

[1] Mat. Med., i. 479. [2] Bull. de Thérap., v. 371.
[3] Essays on Various Subjects, etc., pp. 105 and 109.

a tincture made according to the following formula: ℞.—Pulv. guaiac. res. ℥iv; sodæ and potassæ carb. gr. xc; pulv. pimentæ, ℥j; alcohol dilut. Oiss. Digest for a few days, and, when wanted for use, add a fluidrachm or two of spirits of ammonia to every four ounces of the tincture. Of this tincture, a teaspoonful was directed to be given three or four times a day in milk or wine. Although so highly and urgently lauded by its proposer, it would seem to have been successful only in his own hands. We cannot discover a single competent authority to corroborate his statements. In *dysmenorrhœa* guaiac was likewise recommended by Dr. Dewees. He observed that it sometimes increased the severity of the pain at first, even when it ultimately proved effectual. He was led to its employment "from supposing the disease to be a rheumatic affection," a most groundless supposition, as he indeed suspected it to be, but one which Dr. Rigby has since partially adopted. Dr. Wood mentions that he has found this medicine highly useful in painful menstruation.[1] Dr. E. D. Fenner states that in dysmenorrhœa and consequent sterility he successfully made use of a formula recommended by Dr. Falk, of London, into which Canada balsam, oil of sassafras, and corrosive sublimate enter.[2] This combination is analogous to those formerly in vogue for the treatment of constitutional syphilis.

In the subacute and chronic forms of *rheumatism* guaiacum and its resin are undoubtedly efficacious in proportion to the care which is taken to favor their diaphoretic operation. Dr. Graves says that, "whether given in the form of powder or tincture, it often proves an extremely useful remedy in cases of chronic rheumatism where no symptoms of active local inflammation or general fever exist."[3] He preferred, however, to prescribe it in conjunction with cinchona, sulphur, ginger, and cream of tartar.

Guaiac has been recommended in *tonsillitis* by Dr. Hannay, of Glasgow, Mr. Bell,[4] Dr. Carson,[5] and Mr. Carter.[6] According to their statements it abates the pain and inflammation with singular rapidity and uniformity. The dose employed by some is half a fluidrachm of the tincture every six hours. Others prefer twenty grains of guaiac in substance every six hours. It has also been used in *diphtheria*.[7]

Administration.—Of a simple *decoction* of guaiacum wood about a *pint* may be given in twenty-four hours. The compound decoction of sarsaparilla, into which it enters, is more commonly employed. The *resin* may be prescribed in a powder, in doses of from *ten* to *thirty grains*. An alkaline solution forms one of the best vehicles for its administration. A soap is directed as follows in the Prussian Pharmacopœia: ℞.—Liq. kali. caust. ℥j; aq. destill. ℥ij; warm, and add pulv. guaiac. resin. ʒvj.—M. This may be

[1] U. S. Dispensatory, 10th ed., p. 1233.
[2] Am. Journ. of Med. Sci., Oct. 1858, p. 577.
[3] Clinical Medicine, p. 662.
[4] Lond. Med. Gaz., Oct. 1840, p. 202.
[5] Ibid., Nov. 1841, p. 310.
[6] Practitioner, iv. 190.
[7] Am. Journ. of Med. Sci., April, 1862, p. 522.

reduced to pilular consistence, or diluted with water. For immediate use the *Mistura Guaiaci* (Br. Ph.) is sufficient. It is made by triturating half an ounce each of powdered guaiac and powdered sugar, and one hundred and twenty grains of powdered gum Arabic with a pint of cinnamon water. Dose, one to three tablespoonfuls three or four times a day. In rheumatic cases, and those of menstrual derangement, Dewees's tincture, or the *Tinctura Guaiaca Ammoniata*, is to be preferred.

SASSAFRAS.—Sassafras.

Description.—The bark of the root of *Sassafras officinale.* This tree is indigenous to North America, and in favorable situations grows to a height of forty or fifty feet. Almost all parts of the tree are more or less aromatic, but its active principle resides principally in the bark of the root, from which an essential oil is obtained by distillation. When chewed, it has a warm aromatic taste, and diffuses a peculiar and fragrant odor.

Action and Uses.—Sassafras bark is believed to be somewhat stimulant, to quicken the pulse slightly, to promote the digestion, and increase the secretions of the skin and kidneys. It was originally employed in the treatment of constitutional *syphilis*, and has been much used in certain *chronic affections of the skin*, but there is no reason to believe that it possesses any specific virtues. It still forms an ingredient of several compound officinal decoctions, from which, however, its active properties must be in a great measure dispelled by heat during their preparation. It is much employed in the form of simple infusion, as a domestic remedy, and also in a fermented liquor, or beer, as a popular beverage in the spring season of the year, under the idea that it "purifies the blood."

Administration.—An *infusion* may be made with half an ounce or an ounce of the bark and half a pint of hot water, and may be used *ad libitum.* Of the *essential oil* (Oleum Sassafras) two or three drops may be given at a dose.

SERPENTARIA.—Serpentaria.

Description.—"The root of *Aristolochia serpentaria*, of *Aristolochia reticulata*, and other species of Aristolochia." Serpentaria, or Virginia snakeroot, is an herbaceous plant which grows chiefly in the Middle and Western States of the Union, in shady woods, and especially upon hill-sides. It has a perennial root, composed of numerous slender fibres arising from a short, knotty caudex. As found in the shops, the odor of the root is aromatic and agreeable, resembling that of camphor, and it has a pungent, bitter, and aromatic taste. Alcohol and water extract its virtues, which appear to depend upon a volatile oil and a resin, the former of which concretes into a substance resembling camphor. Chevallier found

in it a yellowish, bitter, and acrid principle, soluble in water and in alcohol.

The officinal preparations of serpentaria are the following:—

EXTRACTUM SERPENTARIÆ FLUIDUM.—*Fluid Extract of Serpentaria.*

Twelve fluidounces of tincture having been obtained by percolation with diluted alcohol from sixteen ounces of serpentaria, it is set aside until two pints and a half more of tincture are obtained. The latter is then reduced to four fluidounces, and mixed with the reserved tincture. *Dose*, half a fluidrachm.

INFUSUM SERPENTARIÆ.—*Infusion of Serpentaria.*

This infusion is prepared by macerating half a troyounce of coarsely powdered serpentaria in a pint of boiling water for two hours in a covered vessel, and straining off the liquid. It may also be produced by percolation. *Dose*, one or two fluidounces.

TINCTURA SERPENTARIÆ.—*Tincture of Serpentaria.*

Four troyounces of serpentaria are percolated with diluted alcohol to the production of two pints of tincture. *Dose*, one or two fluidrachms.

TINCTURA CINCHONÆ COMPOSITA.—Vid. *Cinchona.*

History.—This root was used by the American aborigines as a cure for snake-bites (whence its name), and by the early colonists as a tonic and stimulant. It was introduced into medicine by a London apothecary, named Johnson, in 1633.[1] Sydenham alludes to it as a remedy for intermittent fever, when infused in white wine and taken so as to produce sweating before the fit.[2]

Action.—Its properties have been investigated by Jörg.[3] The powder and the infusion were employed in a large number of experiments made by his associates and himself, and from them he drew the following conclusions: Serpentaria occasions nausea, eructation, vomiting, constriction and pain in the stomach, borborygmi, colic in the small intestine, discharge of flatus, and a disposition to go to stool, but without any evacuation, or of consistent fæces only. The appetite is sometimes impaired and sometimes increased, the stomach and bowels often distended with flatus; itching about the anus, and even hæmorrhoids, are occasionally produced. Hence it would appear that the medicine acts as an irritant upon the alimentary canal, producing gas, but not a secretion of liquid. It appears to operate upon the brain by producing a tendency of blood to this organ, as is shown by a sensation of heat in the face and of dulness or painful fulness about the head. Frequently it quickens the circulation and causes the urine to be voided at shorter intervals of time, but without increasing its amount. Sometimes it appears to stimulate the organs of genera-

[1] MÉRAT and DE LENS, i. 415; STRUMPF, i. 559.
[2] Works, Syd. Soc. ed., ii. 239.
[3] Materialien, i. 179.

tion. Jörg found that in small doses its operation lasts from eight to twelve hours, and in large doses from eighteen to twenty hours. Hence there would seem to be no need of repeating it oftener than twice in twenty-four hours. According to other authorities,[1] it is not only a stimulant, but a tonic and antiseptic, and most powerfully promotes the perspiration. It is often compared to camphor, but its influence is more permanent.

Uses.—In *typhus*, *typhoid fever*, and the *typhoid state* of various diseases, this medicine is indicated when the pulse is small, feeble, and irregular, the skin cool, doughy, and clammy, the teeth and lips fuliginous, the eyes injected and dull, and the mind affected by delirium or insensibility. The still graver condition, marked by dark and fetid urine and fæces, by petechiæ and vibices, gangrene of the skin, etc., is often favorably influenced by serpentaria, especially if alcoholic stimulants be judiciously associated with it. Huxham and Pringle advised it strongly in low forms of fever, but they generally associated it with cinchona.[2] The compound tincture of cinchona, proposed by Huxham, and still employed under the circumstances just indicated, derives a portion of its efficacy from serpentaria. In typhoid *pneumonia*, or rather in epidemic typhoid fever complicated with pneumonia, Richter prescribed it with remarkable success.[3] Among the negroes of South Carolina it is much used in the low stages of pneumonic inflammation to which they are said to be peculiarly liable.[4]

It has already been stated that Sydenham mentioned serpentaria as a remedy for *intermittent fever*. Chapman advises it in *remittent fever*, and particularly in that form of the disease which has been called "bilious pleurisy," and which "has all the characteristics of pneumonia, with the addition of some of the symptoms of autumnal fever." In this affection, after moderate bleeding and evacuation of the bowels, diaphoresis produced by serpentaria sometimes proved curative.

An infusion of serpentaria was recommended, in 1753, by Cadwalader Colden, of New York, in *putrid sore throat*, both as a diaphoretic in the forming stage of the attack, and as a gargle with sumach-berries (*Rhus glabrum*) and alum.[5] Dieu affirms that he arrested a violent fit of the *gout* by the use of a hot infusion of serpentaria, and, by continuing it, three times a day, for a month, prevented a return of the disease.[6] Some persons have also attributed to it *anthelmintic* properties.

Administration.—The *dose* of the *powdered root* is from *ten to thirty grains*. Of the *infusion* the dose is *one* or *two fluidounces* every three or four hours in low forms of fever, but less frequently in chronic affections. Of the *fluid extract* of serpentaria the dose is half a fluidrachm; of the *tincture* it is *one* or *two fluidrachms*; but

[1] SUNDELIN, Heilmittellehre, ii. 135.
[2] Diseases of the Army, p. 270.
[3] Ausfürliche Arzneim., iii. 51.
[4] PORCHER, Trans. Am. Med. Assoc., ii. 766.
[5] Med. Obs. and Inq., i. 210.
[6] Mat. Med., iii. 560.

both are inferior to the *Compound Tincture of Peruvian Bark*, into which serpentaria enters, and of which the dose is from *one* to *four fluidrachms.*

AMMONII CARBONAS.	Vid. *Stimulants.*
POTASSII NITRAS.	" *Diuretics.*
ANTIMONII ET POTASSII TARTRAS.	" *Emetics.*
IPECACUANHA.	" "
SARSAPARILLA.	" *Alteratives.*
MEZEREUM.	" *Irritants.*

DIURETICS.

Diuretics (δια, through, ουρον, urine; διυρητικος diuretic) are medicines which tend directly to increase the secretion of urine.

According to this definition, the number of medicines which in various states of the economy are adapted to promote the urinary discharge would be much more restricted than in practice is found to be necessary or convenient; for in numerous morbid conditions the deficiency of urine depends, not upon any defect in the organs appropriated to the function of secreting it, but to derangements of others which interfere more or less with the action of the kidneys. Or, to go one step further forward, the secretion of urine may be duly performed, but its discharge externally may be prevented by some obstacle in the urinary passages. For example, an obstruction of the ureters may exist, such as a thickening of their coats, or possibly a spasm of their muscles; or, what is more frequent, a calculus, or inspissated mucus, or even an entozoon, may be impacted in the canal. But in such cases the obstacle is usually confined to one of the two organs, and that of the opposite side of the body, assuming the functions of both, effectually accomplishes the depuration of the blood.

The instances in which other organs than the uropoietic prevent the proper secretion or discharge of the urine are also numerous. Of these, some are closely analogous to the group which has just been referred to. Such are physical agencies interfering with the secretion or with the discharge of the urine, or with both at the same time. Everything which mechanically compresses the ureters will prevent the escape of the urine from these canals. By accumulation behind the obstacle, it may gradually distend the ureter and the pelvis of the kidney, causing pressure upon the glandular structure of the organ, and ultimately its atrophy or its distension into a large sac (hydronephrosis); at first, therefore, retention, and afterwards suppression, of urine occurs. Tumors of the ovaries, of the mesentery, and other organs of the abdomen may produce such effects.

But all of these causes, taken together, are few in number compared with those which limit the secretion of the urine by interfering with the free circulation of the blood in the kidneys. Such freedom is essential to the proper action of all glands, and of none more than those under consideration. Owing to the extreme vascularity and the intimate connection of all the abdominal organs with one another, whatever interferes with the due circulation of the blood in one, affects the rest, and in a greater or less degree curtails the freedom and the amount of its discharge. If the intestines are over-distended by fæces, they to some extent impede the proper action of the kidneys, partly by mechanical pressure, partly by impeding the circulation of the portal blood through them, and partly, also, by preventing the absorption of the fluid contents of the bowel. Still more strikingly does congestion of the liver or spleen operate in the same manner, and, most of all, chronic induration of these organs. Obstructive valvular disease of the heart itself exerts a scarcely less marked influence upon the freedom of the secretion of urine, because this organ is connected directly, by means of large veins, with the abdominal circulatory system. Debility of the heart, arising from its atrophy or from fatty degeneration, or associated with a general want of tone in the body, produces an analogous result, for it not only renders the supply of arterial blood to the kidneys comparatively imperfect, but it maintains a congested state of these organs which often results in albuminuria and dropsy. In the preceding cases the hindrance to secretion exists in the pressure of the blood itself, or in its defective supply; but it often happens that a peritoneal effusion which distends the abdominal walls to their utmost limits may prevent the proper circulation of blood in the organs of the abdomen, and consequently interfere with the secretion of its glands, and especially of the kidneys, which are so placed as to be readily subjected to compression from such a cause.

Closely analogous in their action to these causes are all which, independently of mechanical obstruction, tend to divert the blood from the kidneys. It is a familiar fact that active exercise, which causes a copious discharge of perspiration, diminishes the quantity of urine which is secreted, and that heat produces the same immediate and remote effect; so that, as every one knows, the discharge of urine is copious in winter and scanty in summer, and, as physicians are very well aware, diaphoretic medicines are directly antagonistic to those of the diuretic class. Profuse diarrhœa diminishes the urine in like manner; and, indeed, when the alvine evacuations are excessive and continued, a complete suppression of it may result. Of this a striking illustration is presented by malignant cholera, in which the blood is so completely drained of its liquid parts through the bowels that it ceases to circulate in the vessels, and there is a total suppression of urine.

All febrile states of the system diminish the action of the kidneys as they do that of every glandular structure, whether it be in consequence of the changes which the blood undergoes, and by which

it becomes more dense, and consequently less adapted to enter the capillary vessels in which the function of secretion is performed, or whether it depend upon an infarction of these vessels with such viscid blood, or of the ultimate branches of the efferent ducts themselves with the débris of the destructive processes going on in them, or, finally, upon the mere tension of the bloodvessels from the excessive amount of blood contained in them, and which the suspension of the usual secretions and excretions which in health are discharged from the body must tend to augment.

In the preceding paragraphs several distinct categories have been referred to of diminished discharge of urine, and several examples of each have been mentioned, but in scarcely one of them are diuretics the appropriate remedies, which, indeed, are almost as various as the illustrations themselves. Mechanical causes of obstruction within the urinary organs are, some of them, irremediable, and of one, a calculus in the ureter, although its removal may be favored by diluent drinks, it will more certainly be promoted by opiates and antispasmodics. If defective urination results from the pressure of an accidental formation, such as an ovarian, mesenteric, or other tumor, it is for the most part insusceptible of successful treatment; if from congestion or other remediable obstruction of the liver, mercury may prove the best diuretic, or else saline and resinous cathartics may succeed; or if from a similar condition of the spleen, of miasmatic origin, quinia is the most efficient remedy; in other cases iodine may prove an active indirect diuretic; a purge may produce diuresis by removing the accumulated contents of the bowels, or the operation of tapping by relaxing the over-distended abdomen; digitalis, apart from any direct action upon the kidneys, which it probably does not possess, or prussic acid, independently of such an action, may cause a free discharge of urine when it has been prevented by the irregular or inefficient action of the heart; general depletion is the capital remedy when the imperfect secretion is due to a high febrile action, with tension of the whole vascular system, and even in some cases of general dropsy with fever; and local depletion from the loins is even more certain in its effects when scanty urine is owing to an inflamed or congested state of the kidneys. On the other hand, their secretion may be restored, when it is suspended by a loss of fluids, if appropriate liquids can be retained in the system after their introduction into the stomach or the veins.

Here, then, are numerous means by which the discharge of urine may be increased, and under various circumstances; but they cannot strictly be called diuretics, and hence it was proper in defining this class to restrict the title to medicines, the *direct* action of which is to augment the secretion of urine. By the term urine, however, we cannot understand a liquid which is uniformly of the same composition. Even its physical qualities vary greatly in health and in disease, so that from time immemorial they have been looked upon as affording valuable indications of the nature or the progress of disease. It is strikingly various in density, sometimes scarcely

exceeding that of water, and at other times rising to a sp. gr. 1.030 or more. Now all of its weight above that of distilled water, represented by 1.000, is due to the solid matters which it contains, and which it has derived from the waste of the tissues or of the blood itself. The action of diuretics is shown by the increase of either the watery or the solid constituents of the urine, or of both together. One group is distinguished by its power of promoting the discharge of water by the kidneys, and the other by the large proportion of effete solid matters which it causes to be eliminated; just as there are some cathartics which are called hydragogue, because they evacuate little else than water from the bowels, while others are depurative, and promote the discharge of the several glandular secretions.

Diuretics of the former class, here referred to, have sometimes received the name of *stimulant*, *irritant*, or *acrid diuretics*, and have also been very appropriately called *hydragogue* diuretics, or renal hydragogues. They irritate the tissues with which they come in contact, and when absorbed have a tendency to be eliminated by the mucous membranes or their glands, but chiefly by the kidneys. Among them the principal are these: Squill, copaiba, broom, juniper, guaiacum, savin, buchu, horseradish, mustard, garlic, seneka, digitalis (?), colchicum (?), mezereon, and cantharides. Many possess virtues which entitle them to places in other classes rather than in this, but they all tend in a greater or less degree to be excreted with the urine, and in so doing to stimulate the kidneys and the mucous membrane of the urinary passages. Indeed, many of them, when given in too large a dose, occasion ardor urinæ, dysury, strangury, pain in the kidneys, and even fever, or propagate their irritation to the rectum, exciting tenesmus, and in the female to the uterus and vagina, occasioning hemorrhage, or the catamenial discharge, or abortion from the former organ, and leucorrhœa from the latter. These phenomena might suffice to prove that the diuretics in question are excreted with the urine, but they have also been detected in this liquid either by chemical analysis or by their sensible properties. Thus oil of turpentine and copaiba impart to it peculiar odors, and the essential oils of cubebs, mustard, mezereon, etc., have been distinguished in it.

All of the medicines included in this division, with the partial exception, perhaps, of digitalis and colchicum, may be considered as promoting diuresis by a direct stimulant action upon the kidneys themselves, whereby their normal function is quickened. That is to say, they separate from the blood a larger quantity than usual of whatever this fluid in its circulation through them has to offer, and consequently a larger proportion of water than of any other constituent, unless, indeed, they be given in such doses as not merely to stimulate, but actively to irritate, the kidneys, in which case they cause the escape of the albuminous element of the blood, and even of the coloring matter of its corpuscles. This statement of their mode of action explains their usefulness in the class of diseases to which they are chiefly applied, viz., dropsical affections.

It was once a prevalent doctrine in regard to the action of the present class of diuretics, in the cure of dropsy, that they stimulate the "absorbents" to remove the effused liquid contained in the several serous cavities of the body or in the cellular tissue; but it is now certain that the veins, and not the absorbents, are the principal channels through which the absorption takes place, and not by virtue of any active property residing in them, but simply because, in obedience to a physical law, when the veins are drained of the watery portion of their contents, through the kidneys, or otherwise, a transudation of the dropsical effusion tends to occur from the serous cavity which contains it into the denser liquid within the veins. Thus through them as channels between the dropsical cavity and the free surface of the kidneys, the water is, as it were, pumped out of the system. This rationale is most applicable to dropsy produced by mechanical causes, and independent of inflammation of the serous membrane in which the effusion is contained. When the latter condition exists the membrane may be no longer in a condition to allow the passage of water through it, or at least without a greater force being applied to it than the one just mentioned. Indeed in both of these cases the association with diuretic medicines of others which are adapted either to produce resolution of an indurated parenchymatous organ, or to promote the absorption of the false membrane which acts as a barrier to the passage of the effusion into the bloodvessels, will expedite the cure, or may constitute an essential element of it.

In many cases the efficient cause of dropsy is unknown or only conjectural, and then the exhibition of diuretics should be cautiously resorted to. If the more favorable condition should be present, viz., that in which there is no mechanical and insurmountable impediment to the cure, it will be best secured by means of these medicines. Or if, on the other hand, such an obstacle should exist, as in cases of obstructive disease of the heart, they may still promote the evacuation of the effused serum, and thereby promote the comfort of the patient, and prolong life although it may be impossible to save it.

There is, moreover, a choice to be made among diuretic medicines in the several forms of dropsy, and it frequently happens that a combination of a renal hydragogue with a depurative diuretic is much superior in efficacy to either alone. Indeed, in the simplest of all the varieties of this affection, general anasarca produced by cold, it is found that members of the former class are more efficient than those of the latter, that acetate or bitartrate of potassium will evacuate the water much more rapidly than juniper, broom, squill, etc., but not so much so as a preparation in which both are associated. If an inflammatory element underlies the dropsical effusion, it should be combated chiefly with alterative doses of mercury and with digitalis, during the continuance of the active symptoms, and afterwards with these agents in conjunction with squill. If, in ascites, the liver is the organ upon which the dropsy depends, mercury is usually exhibited in conjunction with taraxacum, colchicum, or squill; a method which is rather in harmony with the exigencies

of an hypothesis, than the result of clinical experience. But if the effusion is connected with a persistent albuminous state of the urine, the use of mercury is generally contraindicted, and often involves serious danger, so that the cure by diuretics must be confided to digitalis, and the saline diuretics. In more chronic cases, with an enfeebled condition of the system, diuretics of the stimulant class, such as oil of turpentine, copaiba, horseradish, and even cantharides, may be used with advantage, or the astringent diuretics uva ursi and pipsissewa may be employed. Finally, when dropsy is the effect of an organic disease of the heart in which this organ pulsates irregularly, the action of digitalis as a sedative of the heart's tumultuous or otherwise imperfect rhythm, if not as a direct diuretic, gives it a pre-eminence over all other medicines of its class.

Diuretics of the second group which eliminate a large proportion of effete solid matters from the blood, have received the name of *renal depuratives*. Formerly, a great many diseases were held to depend upon an acrimony in the blood. By this term was understood certain particles, which, by their shape or their chemical action, irritate the tissues, and thus give rise to the local phenomena of disease. However plausible this doctrine may have seemed, it is not supported by the actual observation of any such morbid agents, nor by any arguments, by the way of exclusion, which prove the necessity of their existence. The effects of miasmata and various more tangible poisons we are acquainted with, and the probable explanation of their morbific agency is that they act upon the blood catalytically, or in the manner of a ferment. As regards many diseases, it may be assumed that they arise from a retention in the blood, not of substances essentially foreign to it, but of some animal products which have assumed a new form, rendering their presence in the system incompatible with health. In other words, they are the excrementitious matters of nutrition. As, next to the fæces, the urine of all the excretions contains the largest proportion of such substances, a diminution of the quantity of it excreted necessarily involves a greater or less deterioration of the blood, and its renewed or augmented discharge as necessarily tends to the purification of the vital fluid, provided that the solid effete matters contained in it equal or exceed the normal proportion.

It has already been stated that if stimulant diuretics are administered to a healthy person, the urine will not be found, under their influence, to contain an increased proportion of solid matters. The experiments of Krahmer, and of Dr. Hammond,[1] prove this conclusively. But if a saline diuretic is made use of in a similar experiment, its effect is enormously to augment the solid contents of the urine, and not by the saline substance alone which was taken, but by urea, uric acid, and various organic matters. Much more is this the case in many diseases. Often, indeed, the kidneys appear to form the principal outlet for substances which are useless and may be injurious in the system. In jaundice, when the flow of

[1] Am. Journ. of Med. Sci., Jan. 1859, p. 278.

bile into the duodenum is interfered with, the urine becomes charged with it, or at least with its coloring matter. In other obstructions of the portal circulation involving the liver and spleen, a large amount of purpurine is found in the urine, a substance which is said to be essentially connected with the non-elimination of the carbonized elements existing in the portal blood. Indigo has also been detected in this secretion. Certain noxious substances, also, received from without, such as mercury and lead, may be eliminated with the urine after having remained for a long time quiescent in the economy.

The diuretic agents which thus depurate the blood are chiefly water and saline solutions. In acute febrile diseases, and in those of a more or less chronic character attended with local inflammation, there can be no doubt that whatever tends to renovate the blood, even in its aqueous portion, must aid in removing from the system, as well the actually effete matters circulating in the blood as those which still maintain a feeble organic connection with the solids. As we observe, even in the external appliances of surgery, the advantage of washing away the results of disorganization of the tissues, we may plausibly infer that a constant renewal of the great solvent element of the blood in like manner hastens the separation of morbid particles of the solids, and their elimination with the urine. Thus Becquerel first remarked that even in health, and although the quantity of solid food remained the same, the amount of solid matter in the urine is somewhat increased by increasing the quantity of water used as a drink.[1] This statement was fully confirmed by Bird, who explained by its means the efficacy of numerous springs famous for their curative virtues in chronic disorders, and which are but little, if at all, mineralized.

Those diuretics which augment the proportion of solid matters in the urine ameliorate the symptoms of many diseases which are regarded as most probably dependent upon a specific or otherwise noxious matter in the blood. It seems probable, therefore, that they decompose, destroy, and eliminate a material morbid cause circulating in the blood, or, what is quite as probable, that they promote the elimination of the effete substances which have been produced by the action of that morbid cause, and thus literally purge the capillary bloodvessels of the noxious materials with which they are loaded, and which interfere with all the processes of a healthy nutrition. It seems to be a rational opinion that every disease, and especially every febrile disease, is attended with an increase of the destructive processes proper to the economy, while the organs destined for the elimination of the resulting substances become engorged and unable efficiently to continue their function. This is evidently the case in regard to the liver in miasmatic affections, in which, while the disease is in activity; the secretion of bile is diminished; or if temporarily increased, it is only so because a sudden and excessive afflux of blood towards the

[1] Semeiotique des Urines, 1841, p. 140.

organ has taken place. But subsequently the secretion is diminished, and the liver becomes engorged and swollen. Even the spleen, which, in some sense, is a gland placed upon the channel of the circulation to accomplish certain changes in the blood which passes through it, becomes, in like manner, distended, in part by mechanical pressure from behind during the cold stage of the paroxysm, but also, in some degree, it may be, by the accumulation of blood in it which is not of such a composition as adapts it to undergo the changes which occur in health, and which is not, therefore, in a condition to be carried forward through the blood-vessels of the organ. During this infarction of the two important organs referred to, the kidneys appear to assume, to some extent, the eliminating function of one, and to relieve both of their congestive distension; the proportion of solid matters contained in the urine is augmented as the evidences of local congestion decline, and the earthy, sallow, or bilious character of the complexion is exchanged for a more wholesome hue. Such, indeed, is the succession of phenomena in the cure of this disease by the powers of nature, or by means not directly addressed to modifying the state of the blood and the secretions. But they present themselves in more rapid succession when treatment is employed which is adapted speedily and frequently to renew the watery element of the blood, and at the same time to quicken its elimination by the kidneys, and also that of the effete and therefore noxious substances which it holds in solution.

As the salts of the alkalies, with vegetable acids, tend to change the reaction of the urine from acid to alkaline, these preparations, as well as solutions of the alkalies themselves, are of the utmost value in correcting the uric acid diathesis, which is the most common of urinary diseases. Benzoic acid, on the other hand, is a useful corrective of the phosphatic diathesis, and of the numerous local derangements of the urinary organs with which it is connected.

The influence of blood depuratives in malarial diseases has already been insisted upon, but it may be proper here to add that, valuable though they may be as adjuvants to the antiperiodic treatment, they are not only unsuited to supplanting it, but are, on the whole, inferior to cathartics in their action as eliminants. In rheumatism, and especially in the acute form of the disease, the relative value of the two classes of medicines is reversed; alkaline, or, preferably, saline diuretics, when freely administered, being among the most prompt of all the means that have been employed to reduce the violence of the attacks.

To obtain the due effects of diuretic medicines they must be managed with a strict reference to the rules which long experience has established, and which have been more or less explained by the conclusions of modern science. Thus all of the class of acrid diuretics require peculiar circumspection in their use; for while by their tendency to the kidneys, and their irritant operation upon them, they act as very certain diuretics, provided that the condi-

tion of the kidneys, and of the other organs, is not inappropriate to their use, they may, by the mere excess of their natural operation, produce renal congestion or inflammation, arrest the secretion of urine, and thus defeat the very end which they were intended to accomplish. It is equally clear that they must be altogether inadmissible whenever a congested or an acutely inflamed state of the kidneys, ureters, or bladder exists, either in consequence of general causes, or owing to the irritation of calculous concretions. But such medicines, cautiously managed, so as to obtain their substitutive influence, are frequently the most efficient remedies for chronic inflammatory states of the same parts, not, indeed, because they increase the urinary discharge, but because they are eliminated with the urine, and communicate to it their qualities. Juniper, copaiba, turpentine, and cantharides are the most important agents of this description, and are of the utmost value in disorders of the mucous membrane of the urinary organs. They and their associated medicines are generally inappropriate when the urine contains sugar, or fatty matter, or blood, and should be very circumspectly employed in dropsy accompanying albuminous urine, even when the amount of the dropsical effusion renders an evacuant of the serum necessary.

Renal depuratives, and here saline diuretics are chiefly referred to, require for their due effect that they should be given in small doses and largely diluted, for otherwise they act as irritants of the bowels, and purge. This, indeed, is true of other diuretics, and in a marked degree of spirits of turpentine. The tendency of salines to be discharged either by the kidneys or by the bowels, depends in some degree upon individual peculiarities. Many persons resist the purgative action of saline mineral waters altogether, and, in many, even sulphate of magnesia acts more upon the kidneys than upon the bowels. Alexander mentions that except in enormous doses, this agent always produces a diuretic effect upon the horse. Besides the direct irritant action, upon the bowels, of saline medicines when given in large doses, and in a comparatively small quantity of liquid, which renders their action purgative, this action is greatly augmented by the attraction which they exert upon the watery constituent of the blood, for as the saline solution is denser than the liquor sanguinis, the latter transudes into the intestine and forms the liquid stools which are discharged. When largely diluted, on the other hand, saline medicines are absorbed, become diuretics, and are eliminated almost altogether with the urine. Such dilution is, then, the necessary condition of their proper diuretic operation.

In many instances the combination of medicines belonging to the class of acrid diuretics with the depurative agents, is of very superior value to the use of either of them alone. Indeed, there are few compounds intended to be diuretic which do not contain members of both classes; digitalis or squill is associated with acetate or nitrate of potassium, juniper with bitartrate of potassium, etc., and these are conjoined with indirect diuretics in such cases

as are referred to at the beginning of this article. Such combinations must be varied from time to time in chronic cases of disease requiring the use of diuretics, for it is the case with these as with all other medicines, that their proper effect is diminished by habitual use.

The greater number of diuretic substances may be divided into the following groups:—

Dietetic.—Water, the great diuretic and lithontriptic agent; sugar, whey, buttermilk.

Fruits, containing acidulous or saline elements, as apples, pears, grapes, and their fermented juices, wine, perry, and cider, and also small beer; watermelons, and especially their seeds.

Vegetables, containing a saccharine or a peculiar principle, as carrots, parsnips, celery, and asparagus.

Medicinal.—*Emollient*, as poppy and hemp seeds, and almonds.

Acidulous, as carbonic, citric, tartaric, boracic, and benzoic acids, and many of their salts.

Alkaline, as the carbonates and bicarbonates of potassium and sodium, and alkaline mineral waters; liquor potassii.

Volatile oils and *ethers*, in wines, or separated; the volatile principles of dill, fennel, parsley, mustard, scurvy-grass, horseradish, copaiva, cubebs, buchu, onions, garlic, etc. Oil of turpentine, juniper, cajeput, and tar.

Acrid substances, such as cantharides, squill, savine, seneka, digitalis, mezereon, and broom.

Astringents, as uva ursi and pipsissewa.

From this catalogue, incomplete as it is, it will be seen that the number of agents which tend directly to increase the urinary secretion is very great, and that very many and indeed the majority of them belong to other classes even more appropriately than to this. Although the lovers of rigorous classification may be embarrassed by this possession of multifarious qualities by the same medicine, we cannot blame Nature because she has chosen to endow certain of her productions so richly.

POTASSII CARBONAS.—Carbonate of Potassium.

POTASSII CARBONAS PURA.—Pure Carbonate of Potassium.

POTASSII BICARBONAS.—Bicarbonate of Potassium.

Description.—The preparation and properties of carbonate of potassium have already been described. Bicarbonate of potassium is prepared by passing through carbonate of potassium in solution a stream of carbonic acid gas, and evaporating the liquid. It forms

colorless, transparent, octohedral crystals of a saline and caustic taste. It is soluble in four times its weight of cold water.

Action.—Like pure potassa, carbonates of potassium act as local irritants, but less energetically than it. The poisonous operation of the carbonate has been described in another place. (See *Irritants*.) The bicarbonate is much milder in its action, and hence it is to be preferred for internal administration. It increases the quantity of the urine and renders it alkaline.

Uses.—The most valuable application of this medicine is to prevent the formation of *uric acid* deposits in the urine. For this purpose it should be taken several times a day in doses of twenty or thirty grains, dissolved in half a pint or more of water. The bicarbonate, as before intimated, is the more eligible preparation, as well on account of its milder taste, as because it may be rendered quite acceptable to the stomach, by adding to each dose enough lemon-juice or citric acid to cause effervescence. Even when *stone* actually exists in the bladder, the use of this solution tends greatly to blunt the sensibility of the coats of the organ, and probably to moderate the inflammation which the presence of a foreign body must ultimately produce, and which may issue in complete disorganization. By such a palliative operation the salt diminishes, also, the irritability of the bladder which prompts to frequent and painful attempts to void the urine. The tendency to calculous affection may also be lessened by neutralizing the acidity developed in the stomach and bowels in feeble states of the digestion. Thus, a scruple of the carbonate or bicarbonate of potassium with four or five grains of nitre, as recommended by Dr. Prout, may be taken four or five hours after a meal.

Theoretical notions of its action, according to which it was classed along with mercury, led to the employment of potassium carbonates in *pseudo-membranous* affections, *glandular enlargements*, etc. But experience has not fulfilled the anticipations of the physiologico-chemical school. In vain it was used in puerperal peritonitis, in croup, in pneumonia, and other inflammatory affections, by physicians of skill and reputation. It is never relied upon now in such diseases; nor indeed was it by those who at first urged its value most earnestly, for they conjoined mercury with it in every instance.

In certain forms of *jaundice*, not easy of recognition, however, but such as are supposed to depend upon inspissated bile, these preparations are sometimes useful, perhaps by their catalytic action upon the blood. Under the circumstances mentioned, however, the carbonates of potassium would appear to promote the excretion of the biliary fluid. The cases in which they are most evidently beneficial are those in which jaundice occurs in persons of intemperate habits, before the degeneration of the liver has gone so far as to produce ascites. Under these circumstances they may be given in some bitter infusion, such as that of wormwood.

In Scotland carbonate of potassium has from time immemorial been used in conjunction with cochineal as a remedy for *whooping-*

cough. Dr. Wachtl, of Vienna, found its effects instantaneous(?) and constant.[1] It has also been commended by Gregory, Armstrong, and others, but it is not employed at the present time.

Carbonate of potassium has formed one of the ordinary medicines in the treatment of *skin diseases* for a long time past. Internally, it appears to be best adapted to cases in which the digestive and urinary organs are at the same time deranged, and a superabundance of acid is formed in the system. Externally it is applied in lotions, baths, ointments, etc., for the relief of the chronic forms of scaly, pustular, and other species of eruption.

Administration.—The dose of carbonate of potassium is from *ten to thirty grains*, and of the bicarbonate *double this quantity*. For external use, a lotion composed of *one hundred and twenty grains* of the carbonate in *a pint of water* may be employed, or an ointment containing from *ten to sixty grains* of this salt in an *ounce* of lard.

POTASSII NITRAS.—Nitrate of Potassium.

Description.—Nitre (Nitrate of Potassium) is a natural and also an artificial product. It abounds in the soil and in fissures of calcareous rocks, in various parts of the East Indies and Spain, in the Mammoth Cave of Kentucky, and other caves in the soil of which large quantities of animal remains exist. The oxygen of the atmosphere is supposed to unite with the nitrogen of the ammonia which these substances contain, generating nitric acid, which combines with the alkaline and earthy bases present in the soil. Nitre is also contained in certain plants, *e. g.*, tobacco, the sunflower, hemlock, etc., from the ashes of which it may be obtained by lixiviation. Of the artificial sources of this salt, the principal consists in bringing alkaline or earthy bases, including potash, into contact with decaying nitrogenized matters. A gradual reaction is produced by the presence of moisture and atmospheric air, at a temperature of about 60° F., which results in the generation of nitric acid and potassium in combination. Various expedients are employed in different countries to effect this object, but the most common is to allow urine to remain for a long time in contact with vegetable matters, by which means the nitrogen of the liquor unites with the alkaline bases contained in the vegetable remains. Nitre is also produced artificially in decomposing nitrate of sodium by means of caustic potash.

Nitrate of potassium usually occurs in long, striated, prismatic, and semi-transparent crystals. Its taste is sharp, and somewhat bitter, and it gives a sensation of coolness to the tongue. "It dissolves in four or five times its weight of cold, and in about two-fifths of its weight of boiling water," and generates cold during its solution. It has the property of preserving meat from putrefaction, and of giving it a bright red color.

[1] Gibb, On Whooping-Cough, pp. 312, 320.

History.—The history of nitre is very obscure. The terms *natron* and *nitrum* are applied, by Greek and Roman writers, to soda and its carbonates, and yet nitre must, as an abundant and widely diffused natural product, have been known at all historical periods. Allston, after examining the question of its origin, concludes by saying, "When, how, and by whom it was invented I cannot find." According to Richter,[1] it was first employed as a medicine by Geber, in the eighth century. But this great alchemist was not a physician.

Action. *On Animals.*—Orfila made various experiments upon dogs with nitre, introducing a solution containing from two to twelve drachms of it dissolved in four ounces of water into the stomach, and tying the œsophagus. The animals made attempts to vomit, seemed unsteady and giddy, uttered cries of pain, had spasms of the extremities, dilatation of the pupils, and feebleness of pulse, followed by general insensibility and death. The stomach was found injected, its veins were distended, and in some points blood was extravasated beneath the mucous membrane.[2] When introduced into a wound, the part became inflamed and sometimes even gangrenous, but no general symptoms of poisoning were manifested. A solution of the salt injected into a vein is generally fatal after having produced convulsions.

On Man.—The effects of nitre upon the human economy vary greatly with the dose and the degree of its dilution. Opinions have differed very much respecting its essential operation, and to this day they may be regarded as unsettled. In the last century, Alston[3] described it as resolvent, antiseptic, antiphlogistic, diuretic, purgative, and anaphrodisiac; and Boerhaave expressed similar opinions. This philosopher noticed its power when mixed with freshly-drawn blood to prevent its coagulation and to brighten its color. Alexander[4] observed that it acted upon the skin, or upon the kidneys, according as the patient took warm or cold drinks. In Löffler's account of a series of experiments performed upon themselves by five young men, all in good health, a drachm of the salt, it is said, was taken the first day, and the dose gradually increased until between three and five ounces in all were taken. The symptoms observed were these: general weakness and indisposition to exert either body or mind, low spirits, facility to be fatigued, disposition to sleep, and a slow and weak pulse. The pulse gradually became less frequent, until towards the end of the experiments it was several times reduced to twenty beats in the minute; nor did it recover its normal frequency for seven or eight days after the discontinuance of the medicine. The appetite and digestion were unaffected, and the bowels were only purged occasionally. There appeared to be some degree of diuresis.[5] In Jörg's experiments[6]

[1] Ausfürlich. Arzneim., iv. 237.
[2] Toxicologie, i. 352.
[3] Materia Medica, i. 179.
[4] Experimental Essays, p. 117.
[5] SCHMIDT'S Jahrbuch, 1848, and Edinb. Month. Journ. and Retrospect, April, 1849, p. 91.
[6] Materialien, p. 48.

the quantity of urine was so uniformly augmented as to cause this effect to be regarded by him as the principal one. He found that, soon after the medicine was taken, undissolved or in strong solution, it produced a sense of dryness in the fauces, thirst, craving appetite, and heat in the stomach like that of inflammation, with eructations, and sometimes, if the dose was large, vomiting, flatulence, colic, and diarrhœa, with tenesmus, or on the other hand, constipation, either with perspiration or an increased flow of urine. Jörg hence concludes that nitre cannot, any more than arsenic, be called an antiphlogistic; that it is an irritant; and that its continued use must impair the digestion. The latter statement is certainly true, but it does not disprove the "cooling" or sedative action of the remedy upon the system generally when taken in a due state of solution, nor does it contravene the assertion that nitre diminishes the plasticity of the blood, and may even induce a scorbutic state of the system.[1] This change in the blood was more precisely defined by Löffler, who found, in his experiments, that the proportion of the solid constituents of the blood was reduced by nitre, as well as the firmness and elasticity of its clot. The same condition was observed by Dr. Basham.[2]

Martin-Solon, in his observations on the use of nitre in rheumatism, states that in many cases it brought on diarrhœa, which, however, ceased spontaneously, or else was readily controlled. Sometimes, indeed, constipation was produced, even when very large doses, such as two ounces, were taken. No durable derangement of the digestion was observed to ensue.[3] The same immunity is also asserted by Devilliers and by Mérat and De Lens.[4] The diuretic properties of the salt are, according to Martin-Solon, very slightly, if at all, marked. The quantity of urine was increased in proportion to the liquid taken, but the specific gravity of this secretion was not lowered, because the nitre itself passed off by the kidneys, and could be recovered from the urine by evaporation. Dr. Basham, in his observations, found that the specific gravity of the urine was raised to between 1030 and 1040. Drs. Wilks and Taylor estimate at about one-half the proportion of nitrate of potassium eliminated by the urine.[5] Dr. Bennett, who witnessed the extensive use of the medicine by M. Gendrin, states that the renal secretion is decidedly augmented. But where several quarts of fluid are used during the day, it must clearly be difficult to attribute its due share, if any, to the increased activity of the kidneys. Dr. Austin Flint administered this substance, in quantities varying from sixty to two hundred and forty grains in the twenty-four hours, to four persons with ascites depending upon cirrhosis, and to two affected with Bright's disease. In all there was an immediate increase of the quantity of urine and the amount of solids contained in it, and in about equal proportions.[6]

[1] Compare M. SOLON, loc. inf. cit., VOGT, ib., and RICHTER, iv. p. 239.
[2] Lancet, Nov. 25, 1848.
[3] Bull. de Thérap., xxv. 250.
[4] Dict. de Mat. Méd., v. 479.
[5] GUY'S Hosp. Rep., 3d ser., ix. 173.
[6] Amer. Med. Monthly, Oct. 1860.

When large, but not poisonous, doses of nitre are taken, the symptoms seem to indicate derangement of the nervous system chiefly. Jörg enumerates among them giddiness, headache, and confusion of ideas. Dr. Cargill, in an interesting paper upon the subject, says that general debility of the limbs, especially of the lower extremities, is complained of, so that patients believe themselves to be seized with general paralysis. The speech is also affected, and there is general trembling, the memory is sometimes affected, and there is also giddiness with painful rushing noises in the ears.[1]

When the dose is poisonous, the symptoms are various. The stomach is generally the seat of burning pain, sometimes preceded by a sense of extreme coldness at the epigastrium. Then vomiting succeeds, with violent colic, purging, coldness of the extremities, a feeble and thready pulse, convulsive movements of the face, trembling of the hands and limbs, insensibility, blindness, deafness, etc. Alston mentions a person who was several times attacked with paralysis of the upper extremities from using this salt. In a case reported by Husemann, in which from one and a half to two ounces of saltpetre were swallowed, there was vomiting of blood, and bloody stools. The patient recovered; but on the fourth day even oatmeal gruel excited pain in the stomach.[2] Dr. Davies has published a case in which a female, after taking an ounce of this substance, presented the very symptoms which have just been described, but in a more aggravated degree. "She lay quite unable to move for about a week, and then a dreadful diarrhœa took place, with awful griping and bloody stools." Yet this patient recovered.[3] Sometimes few or none of these symptoms present themselves, even in fatal cases. A case is reported in which an ounce proved fatal to a healthy man in about twenty minutes. He vomited violently.[4] Dr. Snowden[5] relates the case of a man who took, by mistake for Epsom salts, three ounces and a half of nitre at one dose. His bowels were opened three times within as many hours; he complained of slight pain in the epigastrium, and drank a good deal of water. About five hours after having taken the saltpetre, he suddenly fell out of his chair and expired. No dissection of the body was made, but the lips remained of a lifelike pink color on the third day after death. In this case the sudden death may perhaps be attributed to the erosion of a large bloodvessel of the stomach. In the absence of violent nervous symptoms it may be compared with one or two earlier cases. Such an one is recorded by Butter[6] of a pregnant female, who, after taking an ounce of nitre, vomited blood, but had no other active symptoms with the exception of choreic spasms which lasted for several days. No doubt a large proportion of the poison was vomited. Another case is reported

[1] Lond. Med. Gaz., Oct. 1851.
[2] REIL's Journ. f. Pharm., ii. 178.
[3] Lancet, Nov. 1857, p. 484.
[4] Ann. d'Hygiène, 2ème sér., xvi. 400, where several other cases are given.
[5] Phil. Med. Exam., April, 1855, p. 244.
[6] Ed. Med. and Surg. Journ., xiv. 34.

by Vanoye,[1] in which a female, sick with typhus fever, took an ounce and a half of nitre by mistake. She vomited bile and a large quantity of blood, but afterwards recovered.

In fatal cases, after death the contents of the stomach sometimes consist in part of blood; the gastric mucous membrane is of a dark red color, sometimes corroded; its veins are distended, and blood is effused within and beneath it. The upper portions of the small intestine are more or less in the same condition.

Uses. *In Rheumatism.*—Nitre was employed for the cure of this disease towards the close of the last century in England, by Brocklesby, Macbride, and Whytt. The first-named physician gave ten or more drachms of it in twenty-four hours dissolved in four or five quarts of barley-water. Copious sweating and great improvement or recovery ensued, it is said, within three or four days. In later times this práctice was revived in France by Gendrin and Martin-Solon, to the latter of whom we owe the fullest details of its results.[2] He was of opinion that the method was not only devoid of risk, but possessed decided advantages. As a medium dose he prescribed one ounce to be taken in the course of the day, but sometimes double that dose, dissolved in a large quantity of weak lemonade or some slightly aromatic infusion, sweetened, and administered every hour. It produced no sensible phenomena other than that in the course of two or three days it caused the pain in the joints to subside, while none were invaded anew, and the attack was cured by the tenth day. Dr. Basham imitated this plan exactly, and reports analogous results.[3] Dr. B. used the solution upon *spongio-piline* as a *local application* to the affected joints, as Alexander had originally done, and found it to relieve the inflammatory symptoms. The testimony of Dr. Rowland is equally favorable[4] to the internal administration of nitre.

Other physicians, it must be confessed, have arrived at different conclusions. Monneret, in particular, could observe no influence produced by the medicine upon the course of the disease, and he speaks in strong terms of the extreme repugnance of the patients to its use.[5] Dr. Fuller, also, who watched its administration to the extent of about an ounce daily in seventeen cases of acute rheumatism, and to a less extent in several others, did not observe that it exerted any decided control over the course or character of the symptoms.[6]

In *chronic rheumatism* this remedy was employed by Dr. Cargill, who reports that in three-fifths of one hundred cases the average duration of the cure was thirteen and three-quarter days. He prescribed two scruples three times a day, but in some cases increased the dose to as many drachms, and administered it always in at

[1] Month. Retros. of Med. Sci., April, 1849, p. 92.
[2] Bull. de Thérap., xxv. 250. [3] Lancet, Nov. 25, 1848.
[4] Lancet, Feb. 1854, p. 149.
[5] Compendium de Méd. Pratique, vii. 393.
[6] On Rheumatism, etc. (Am. ed.), p. 93.

least half a pint of *warm* barley-water, without which it produced griping, pallor of the face, cold perspiration, and a feeble pulse.[1]

There seems then to be no doubt of the efficacy of nitre in acute rheumatism, provided that it be given in doses of at least half an ounce daily, dissolved in a large quantity of liquid. On the other hand, it must be admitted that the degree of its success hitherto has not led to its general adoption as an anti-rheumatic medicine.

In other *inflammatory* diseases nitre has been to some extent employed. Alexander states that he ordered it in the quantity of two scruples every hour and a half, and found it often to procure a remission of the symptoms, and either sweating or diuresis. Vogt likewise recommended it in *pneumonia* and other affections in which the blood is covered with a buffy coat.[2] A popular remedy for *sore-throat* (catarrhal pharyngitis) is to allow a small piece of nitre slowly to dissolve in the mouth; but, except in the most superficial forms, it is more injurious than useful. It has been recommended in passive *hemorrhages* depending upon purpura, scurvy, etc.[3] Eberle says that it is beneficial in cases of *dropsy* resulting from suppressed perspiration after an eruptive disease.[4]

In *spasmodic asthma* the fumes of paper impregnated with nitre have been found to render the breathing freer and less stridulous.[5] In some cases their continued use renders the disease quite tolerable, or perfectly cures it. They may be employed by diffusion through the air of the patient's bedroom, or inhaled from a cigarette, or from paper impregnated with nitre, burned under a funnel, from the mouth of which the patient inspires.[6] Dr. Hyde Salter, who has reported some striking examples of its success, calls attention to the importance of using paper which is not so thin as to absorb too little of the nitrous solution, nor so thick as to take up too much of it, nor made of woollen or other fibres which give off acrid fumes in burning.[7] It is also of the utmost importance that the remedy should be resorted to at the very commencement of the paroxysm, and before there is superadded to the nervous element congestion of the bronchial tubes. The utility of nitrate of potassa in spasmodic asthma, taken in connection with the efficacy of tobacco, antimony, and ipecacuanha in the same affection, proves that its mode of action is essentially sedative, and corresponds with the effects of the medicine in large and poisonous doses.

From the well-known efficacy of orange and lemon-juice, as well as of potatoes and other fresh vegetables, in the prevention and cure of *scurvy*, it has been inferred that they owe this property to the potash contained in them, and, consequently, that nitrate of potash would be found an antidote to scorbutic symptoms. But, like so many other scientific anticipations in therapeutics, this one received no confirmation when brought to the test of experience.

[1] Lond. Med. Gaz., Oct. 1851. [2] Pharmakodynamik, i. 302.
[3] BRAITHWAITE'S Retrospect (Am. ed.), xix. 37.
[4] Therapeutics, p. 461.
[5] Am. Journ. of Med. Sci., Jan. 1842, p. 262; Lancet, April 5, 1845, p. 383.
[6] CHALLERY, Abeille Méd., xiii. 259. [7] Lancet, Aug. 1858, p. 223.

On the contrary, the comparative trials which were instituted on board of an English convict ship,[1] led to the conclusion that nitre is destitute of the antiscorbutic qualities that have been assigned to it, while its nauseous, mawkish taste, and injurious effects on the system generally, rendered it worse than useless. It is true that, as early as 1794, Mr. Patterson advised a solution of nitre in vinegar as preferable to lemon-juice in scurvy; and in 1829 Mr. Cameron found this same solution, or that of nitre in lemon-juice, to be a very effectual cure; but results obtained from such mixtures are far from being a measure, or even an indication, of the value of nitre itself as an antiscorbutic.

Although classed with diuretic medicines, and capable of exerting a diuretic action, nitrate of potassium is very seldom used in the treatment of dropsical affections, for the cure of which so many other agents operate in a more certain and agreeable manner.

Administration.—Nitre may be given in doses of from *ten to thirty grains or more*, in the form of powder or in solution. The latter is the preferable mode, and the quantity of liquid employed should be large. When an overdose of nitre has been taken, the only efficient antidote is water, or some bland liquid, by means of which whatever portion of the salt continues undissolved may be rejected, and what remains may be diluted so much as to render it innocuous. The gastric inflammation is to be combated by cold drinks, leeches to the epigastrium, etc.

POTASSII ACETAS.—Acetate of Potassium.

Description.—Acetate of potassium exists in the juices of many plants. It is prepared artificially by the action of acetic acid upon bicarbonate of potassium, or by the double decomposition of acetate of lead and sulphate of potassium.

This salt is white, foliated, and has an unctuous feel, and a warm, pungent, and saline taste. It attracts moisture with great rapidity; and is converted by it into a liquid of oily appearance. Hence it should be carefully excluded from the air in well-stopped bottles. It is soluble in about half its weight of water, and twice its weight of alcohol. Nearly all of the acids decompose it.

History.—According to Richter,[2] this preparation was known to the ancients, and is mentioned by Pliny. However this may be, Raymond Lulli was the first to describe it accurately, and Sennertus rendered its use general.

Action.—According to Wibmer, Richter, and other German authors, it acts upon the blood as a solvent and diluent, as a depurative upon the glands and mucous membranes, especially of the abdomen, augments the secretion of bile, urine, and sweat, and does not readily disorder the digestion. In doses of from half an ounce

[1] Bryson, Med. Times and Gaz., March, 1850, p. 213.
[2] Ausfürl. Arzneim., iv. 328.

to an ounce it is a mild laxative. It undergoes decomposition in the system, and is discharged with the urine as carbonate of potassium, rendering this liquid alkaline. Like other diuretics of the saline and alkaline classes, it augments *not only the watery, but also the solid* elements of the urine to the extent, as Golding Bird has shown, of even one hundred and ninety grains of extractive in the twenty-four hours.[1] These results have been confirmed by the observations of Dr. Austin Flint.[2] It is this power of depurating the system which constitutes the great value of alkaline diuretics, and which the older writers as well as some of the German authors nearer the present day, have in view when they speak of its relieving the infarcted viscera, and attenuating the secretions of the abdominal organs inspissated by constitutional cachexiæ which involve the assimilative functions chiefly. Hence it is classed by them among the resolvents.

Uses.—The older writers describe it as a *depurative* in *chronic congestions of the liver and spleen*, with imperfect secretion of bile, and in *hæmorrhoidal* and *uterine infarctions*, accompanied with nervous and hypochondriacal symptoms, such as follow long-continued attacks of malarial fever; in that depravity of the digestive organs, and of the whole economy, which is often the consequence of a *scrofulous diathesis*, and with which abdominal dropsy is apt to be associated; in cases of *chronic jaundice* depending either upon local or general causes not mechanical; in *lithiasis*, in *gout*, in *furuncles*, *carbuncles*, and various *cutaneous affections* depending upon the gouty diathesis. These effects, which, according to the physiological mode of viewing disease and its treatment, had for a long time been overlooked or made light of, have been demonstrated anew and explained by Becquerel and by Bird. The latter physician has especially called attention to them. "*Jaundice*," he remarks,[3] "connected with a large, sluggish, congested liver, has certainly better yielded to setting up a complementary function on the parts of the kidneys by a diuretic alterant than by goading the liver with remedies whose influence it refused to obey; and in more than one instance a strumously enlarged cervical gland has yielded to the persistent use of an analogous remedy, even after resisting the iodide of potassium." This author shows, further, how the depurative action of the remedy corrects the *malarious cachexia*, and renders the previously ineffectual preparations of bark or arsenic sufficient for the cure of periodical fever. Even in recent *tertian ague* he found that when the paroxysms were well marked it diminished their intensity.

Of the use of acetate of potassa in *acute rheumatism*, Dr. Bird says: "I have seen the cure to be more rapid, and the immediate relief to the patient more marked by the use of the acetate of potassa in quantities of half an ounce, administered, largely diluted, in divided doses, in twenty-four hours, than by any other treat-

[1] On Urinary Deposits (2d Am. ed.), p. 356; and EASTON, Month. Journ. of Med. Sci., May, 1850, p. 422.

[2] Am. Med. Monthly, Oct. 1860.

[3] Op. cit., p. 359.

ment. In three days, I have repeatedly found the exquisite pain of the joints nearly absent." He was also impressed with a belief that it lessens the chance of cardiac complications, if given so as to render the urine alkaline. He used no other treatment than this salt, except, perhaps, a full dose of Dover's powder, when the pains were at the first severe; and the affected joints were always wrapped in cotton wadding. In this and in the other affections distinguished by an excess of uric acid, it acts in the same manner as the analogous compounds with vegetable acids; that is to say, it is decomposed, the acid absorbs oxygen, and is converted into carbonic acid and water, of which the former unites with the base, and, on being secreted with the urine, neutralizes its free acid, or even renders the liquid alkaline.

Alluding to the cachectic states accompanied by *glandular engorgements* and *furunculous eruptions*, and those deranged conditions usually styled *bilious*, Dr. Bird assures us that the advantage gained by the use of this remedy is remarkable. Thus it is that in all points he confirms the conclusions of the earlier physicians above referred to, but which have been too long allowed to remain without practical extension, even when they were not discredited.

In several forms of *dropsy*, acetate of potassa is a valuable diuretic. So distinct is its operation on the kidneys, that it formerly was known as *sal diureticus*. Alibert found it very serviceable in *hydrothorax*. Voigtel states that it is peculiarly efficient in *jaundice* and *dropsy* depending upon "torpor of the liver." Other writers prefer it to be given associated with squill or digitalis. In cases of idiopathic and scarlatinous anasarca we have used it with almost uniform success, even when prescribed alone. If it fail to act, or if it do so imperfectly, the addition of the articles just mentioned will nearly always provoke abundant diuresis. It may also be given in the infusion of parsley, broom, dandelion, etc.

In several forms of skin disease, particularly *psoriasis* and *eczema*, this medicine has been very successfully employed by Dr. Easton, of Glasgow. Several of the cases reported by him had resisted other methods of treatment.[1]

As a *diaphoretic*, the acetate of potassa has long been celebrated in the form of the *potio Riverii*. This is made by saturating with vinegar two drachms of carbonate of potassa, and adding six ounces of sweetened water. A tablespoonful every two hours is the proper dose. Like the neutral and effervescing draughts, and the spirit of mindererus, it acts as a gentle sedative, promoting the secretions of the skin, kidneys, and bowels, and is of much use in febrile affections.

Administration.—This salt should always be administered in a large quantity of liquid for all purposes except that of producing diaphoresis. In febrile affections, as a sedative, its dose is *ten grains*. In rheumatism, *thirty grains* may be given every four hours. As

[1] Month. Journ. of Med., May, 1850.

an alterative, it may be prescribed in the same or still larger doses. As a laxative, the dose is about *half an ounce.*

SODII ACETAS.—Acetate of Sodium.

History and Properties.—This salt appears to have been first discovered in 1767, by Meyer, of Osnabruc, by directly combining distilled vinegar and carbonate of sodium.[1] It is a white, striated, or octohedral crystalline salt, with a sharp, saline, but not unpleasant taste. It dissolves in three parts of water, and in twenty-four of alcohol. It does not, like the acetate of potassium, deliquesce on exposure to the atmosphere, but effloresces in dry air.

Action and Uses.—Acetate of sodium resembles the acetate of potassium in its action, but is milder. It is also less apt to derange the digestion, while it is even more powerful as a diuretic. It can be employed for all the purposes to which that salt is applied, and, unlike it, can be administered, if desirable, in pill or powder. But this can seldom be required. The *dose* is from *twenty to one hundred and twenty grains.*

Lithium. Vid. *Irritants.*

AMMONII PHOSPHAS.—Phosphate of Ammonium.

Description and Uses.—The neutral tribasic phosphate of ammonium was introduced into medicine in 1846, by Dr. T. H. Buckler, of Baltimore. It comes in white rhombic crystals, and is obtained by saturating a solution of phosphoric acid with ammonia. It is not officinal.

Dr. Buckler was led to employ this medicine in *gout* and *rheumatism* by reflecting that the uric acid, which is so abundantly discharged on the subsidence of a gouty or rheumatic fit, must have been combined in the system with bases, and probably with soda and lime, the materials of gouty concretions, and that probably also phosphate of ammonium would lead to the formation of two soluble salts, the phosphate of sodium and the urate of ammonium, which would be readily eliminated.[2] M. Bouchardat, in a note upon this subject, says that although in practice the apprehension may prove to be unfounded, still one might fear lest the salt should give rise to the formation of an insoluble ammoniaco-magnesian phosphate, and thus increase the risk of calculous disease.[3]

In a number of cases occurring under his own observation, and that of Drs. Power and Frick, Dr. Buckler found that uric acid disappeared from the urine rapidly under the use of this salt. Hence he proposed it as a means of preventing the precipitation of

[1] Sachs u. Dulk, Handwörterbuch, II., ii. 744.
[2] Am. Journ. of Med. Sci., Jan. 1846, p. 108.
[3] Annuaire de Thérap., 1848, p. 98.

uric acid from the urine and the generation of *calculus*, and even of procuring the solution of calculi already formed. Its power of keeping uric acid in solution in the urine was confirmed by Dr. Golding Bird, who considered it to be equal if not superior to borax and phosphate of sodium for this purpose. He also found it of service in the more recent effusions into the joints in the subacute forms of rheumatic gout.[1] He did not, however, attribute to it any influence upon the tophaceous deposits already formed in the joints, etc. The remedy has since been tried by many physicians, and some favorable results of its operation have been published. Dr. Edwards, in England, used it with "great success in almost every variety of gout and rheumatism, both prior to the development of the inflammatory stage and after its partial subsidence." He adopted the explanations of its action suggested by Dr. Buckler, but without naming the source of his first knowledge of the subject.[2] Dr. Mattei, of Bastia, also published several cases intended to show the efficacy of the medicine in gout and rheumatism.

This remedy was fairly tried in acute and subacute rheumatic cases by Dr. W. Pepper, at the Pennsylvania Hospital, and patients recovered under its use sometimes when other plans of treatment had failed.[3] In some instances it nauseated and purged, and Dr. Wells states that he has heard of very unpleasant symptoms following its use.[4] While, therefore, the phosphate of ammonium must undoubtedly be admitted among the available therapeutical solvents of uric acid, it does not appear to possess qualities much, if at all, superior to those of the alkaline carbonates of the vegetable salts. Experience has not, however, pronounced definitely upon its value.

Administration.—Phosphate of ammonium may be given in doses of from *ten to twenty grains*, three times a day, dissolved in water.

ARMORACIA.—Horseradish.

Description.—Horseradish, which is no longer officinal, is the fresh root of *Cochlearia armoracia*, a native of Europe, where, as in other civilized countries, it has long been cultivated as a condiment. It grows in rich and rank soils. The root is long, white, and cylindrical. The stem is about two feet high; its lower leaves are dark green, and lance-shaped; the upper are smaller, and without footstalks. The flowers are white, and in terminal clusters.

Horseradish has a pungent odor, and its exhalations readily make the eyes water. Its taste is warm, acrid, and slightly sweet. It imparts its properties to water, vinegar, and alcohol. They depend upon a volatile oil which is readily dissipated by heat or exposure to the air.

[1] On Urinary Deposits (2d Am. ed.), p. 148.
[2] Provin. Med. Journ., Nov. 1847, and Am. Journ. of Med. Sci., Jan. 1848, p. 239, and Ibid., Oct. 1850, p. 496.
[3] Am. Journ. of Med. Sci., Jan. 1849, p. 49.
[4] On Gout, p. 218.

An *infusion of horseradish* may be made by infusing an ounce, each, of fresh horseradish root and bruised mustard seed in a pint of boiling water, and macerating them for two hours. Dose, a wineglassful three or four times a day. The Compound Spirit of Horseradish (*Br. Phar.*) is prepared by distilling proof spirit upon horseradish, orange-peel, and nutmeg.

Action.—The volatile oil just referred to has, at first, a sweetish but afterwards a very acrid taste. When applied to the skin it acts as a rubefacient. Horseradish in considerable quantities produces a sense of warmth in the stomach, and assists the digestion of animal food. In excesssive doses it creates a burning heat at the epigastrium, followed by nausea and vomiting. It augments the secretion of urine, and perhaps that of the perspiration also. Tiedemann injected an ounce of its juice into the crural vein of a dog, and immediately afterwards detected its characteristic odor upon the animal's breath.[1]

Uses.—Horseradish has been more celebrated for its *antiscorbutic* virtues than for any other property. Linnæus calls it a divine remedy in what he terms scorbutic affections of the chest. Bergius says that he has known a teaspoonful of the scraped root taken every morning fasting for a month, without being masticated, and followed by a draught of tea prepared from juniper tops, to act very beneficially in scorbutic diseases.[2] Cullen remarks that it has the reputation of being most effectual in scurvy when eaten fresh as a salad, or in the form of a conserve of the expressed juice.[3] Cochlearia officinalis, or scurvy grass, an allied species, is, as its name implies, considered to be eminently antiscorbutic.

In recent times, this medicine has not been much employed as a diuretic, but formerly it had some vogue as a remedy for *dropsy*. According to Murray, it acts favorably in atonic forms of the disease. Sydenham included it with several other diuretic plants in his prescription for dropsy following intermittent fever. Huss employed it successfully in *albuminous nephritis*, and Rayer in *anasarca*.[4]

When the digestive powers are feeble and the *appetite fails* in chronic diseases, or from mere exhaustion of the system, it may be used with great advantage as a condiment.

As an *external* application, it is useful when a rapid and decided counter-irritant is required. Murray recommends it mixed with mustard and flour as a revulsive to the soles of the feet in *soporose affections*. As a masticatory in *toothache*, it sometimes affords relief by exciting a flow of saliva, as well as by its counter-irritant action. The infusion has been employed as a gargle in relaxed states of the *pharynx* and *larynx*. A mixture of the juice with vinegar is recommended by Voigtel for removing *freckles* and *tan*.[5]

Administration.—Horseradish-root, grated or scraped, may be

[1] Mitscherlich, Lehrbuch, ii. 559.
[2] Mat. Med., ii. 559.
[3] Mat. Med., ii. 164.
[4] Dubois, Mat. Méd. Indigéne, p. 132.
[5] Arzneimittellehre, iii. 54.

given in doses of from *half a teaspoonful* to *two* or *three teaspoonfuls.* The infusion, which contains mustard-seed, is an excellent stimulant diuretic. The dose is *two fluidounces* three or four times a day. It may be rendered more active by the addition of compound spirit of horseradish, of which the dose is from *one* to *four fluidrachms.*

SCOPARIUS.—Broom.

Description.—The tops of *Sarothamnus Scoparius.* This shrub, which is a native of Europe, derives its name from the bushy stalks (σκοπος) of which it is composed, and which are used for the same purposes as the tops of broomcorn. It abounds in all parts of Europe, where it is used as fuel, but in this country is only cultivated in gardens on account of the sweetness of its flowers, of which the bees are very fond.

Broom tops contain a large proportion of carbonate of potassa. They have a bitter, nauseous taste and a peculiar odor, which depend chiefly upon a volatile base, which is a powerful narcotic resembling conia and nicotine in its action. For this supposed principle the name of *spartein* has been proposed by Dr. Stenhouse, and that of *scoparin* for another which is represented to be diuretic in the dose of five or six grains. But Schroff, after the administration of even a larger dose, observed no diuretic effects, but only colic and borborygmi. The decoction of broom occasionally excites considerable irritation in the kidneys and urinary passages.

Uses.—Broom has long been employed in Europe as a popular remedy, especially for *dropsy.* In Floyer's *Touchstone of Medicines* (1687) it is said to be good "in the scurvy, jaundice, and dropsy," and in Culpepper's *Herbal*, of the same period, the powder of the seeds is described as purgative, emetic, and diuretic, as a cure in dropsy, gout, sciatica, and jaundice, and also as a diaphoretic in ague. Prepared with oil, it is recommended as a cosmetic. Cullen, after learning its popular reputation, employed it in dropsy, ordering half an ounce of the fresh tops to be boiled in a pint of water down to one-half of that quantity, and giving two tablespoonfuls of the decoction every hour until it operated by stool, or the whole was taken. It seldom failed, he says, to operate both by stool and urine, and by repeating the dose every day or every second day some dropsies were cured.[1] Mead speaks of curing an *ascites* by this preparation,[2] and also of the usefulness of the ashes of broom in the same disease. The latter were employed by Sydenham, and are also said to have been used extensively and with success in the treatment of *anasarca* following an epidemic catarrh which prevailed in Sweden in 1757. Itard relates that about 1788 the French government published as a specific for dropsy a prescription which consisted of powdered seeds of broom, and this author

[1] Mat. Med., ii. 534.

[2] Med. Works, p. 390.

states that he employed it with success in two cases, and once with "almost miraculous" effects.[1] The diuretic properties of the ashes have been attested by many writers. The ashes are very abundant, and contain twenty-nine per cent. of carbonate of potassium, to which no doubt, their virtues are principally, if not entirely, owing. Dr. Darwall[2] states that the decoction will, in many instances, remove the effusion when other remedies fail. He remarks, however, that it should be made of the green tops, and drunk for a considerable time in large quantities. Dr. Pearson[3] recommended a tincture of the seeds as preferable to the tops. He considered it superior to other diuretics from its improving the appetite and invigorating the whole system, and was most successful with it in ascites and general dropsy. To these evidences of the efficiency of broom as a diuretic we may add the statement of Pereira that, according to his experience—and he had frequently employed it—it is more certain than any other diuretic in dropsies. Indeed, he says, "I cannot call to mind a single case in which it failed to act on the kidneys."

Administration.—There is no officinal preparation of broom in the U. S. Pharmacopœia. A *decoction* may be prepared by boiling half an ounce of the tops in half a pint of water in a covered vessel for ten minutes. This quantity may be taken during the day. A *compound decoction* may be prepared by boiling broom-tops, dandelion, and juniper-berries, of each half an ounce, in a pint and a half of water to a pint. *One* to *two fluidounces* may be given at a dose.

SCILLA.—Squill.

Description.—Squill is the bulb of *Scilla maritima*, a perennial plant which grows on the coast of the Mediterranean Sea. It is pear shaped, as large as or even larger than a man's fist, and is composed of successive imbricated layers somewhat like the onion, whence it is sometimes called *sea-onion.*

In its fresh state squill abounds in a thick, acrid juice, which acts as an irritant upon the skin, but as this property depends upon a volatile principle, it is in a great measure lost by drying. The more important medicinal operations of the drug are due to *scillitin.* According to Landerer, this is an exceedingly acrid and bitter crystalline substance of an alkaline reaction and vaporizable by heat. Marais describes it as amorphous and uncrystallizable, attracting moisture strongly, soluble in alcohol and ether, but not in water, and intensely bitter.[4] As found in the shops, squill consists of fragments of thin transverse slices of the bulb, which are somewhat contorted. They are generally of a pale, reddish-buff color or else nearly white. They are brittle when dry, but usually are rather

[1] Dict. des Sci. Méd., xxii. 407.
[2] Cyclopæd. of Pract. Med., art. Ascites, i. 166.
[3] Brit. and For. Med. Rev., i. 533.
[4] Annuaire de Thér., 1857, p. 96.

tough. They have also a faint smell, and an acrid, bitter, and nauseaous taste.

The officinal preparations of squill are the following:—

ACETUM SCILLÆ.—*Vinegar of Squill.*

In making this preparation, four troyounces of bruised squill are treated by percolation with diluted acetic acid to the production of two pints of liquid. *Dose*, thirty minims gradually increased to two fluidrachms, and administered in some aromatic liquid.

PILULÆ SCILLÆ COMPOSITÆ.—*Compound Pills of Squill.*

These pills are composed of squill, ginger, ammoniac, soap, and syrup. Each pill contains half a grain of squill, and one grain of ammoniac. *Dose*, as an expectorant, in chronic bronchitis, one pill three or four times a day.

SYRUPUS SCILLÆ.—*Syrup of Squill.*

This syrup is made by dissolving with heat, twenty-four troyounces of sugar in a pint of vinegar of squill, and straining the solution. *Dose*, half a fluidrachm to two fluidrachms.

SYRUPUS SCILLÆ COMPOSITUS.—*Compound Syrup of Squill. Hive Syrup.*

This medicine is prepared by first making a solution, by percolation, of the active properties of squill and seneka, in diluted alcohol and water, converting it into a syrup, and dissolving in it tartrate of antimony and potassium. One grain of the last-named ingredient is contained in every ounce of the syrup. It is a sedative emetic, with an especial tendency to promote the secretion of the bronchial mucous membrane. Dose, from five drops to a fluidrachm, repeated at intervals of ten or fifteen minutes, when it is intended to produce vomiting. Its depressing effects on children are sometimes alarming.

TINCTURA SCILLÆ.—*Tincture of Squill.*

It is made by percolation with four troyounces of squill and diluted alcohol to the production of two pints of tincture. *Dose*, from ten to twenty minims, as a diuretic. It is particularly adapted for application by friction to the skin in cases of dropsy.

History.—Squill is mentioned and its virtues are described by many ancient writers. Besides Hippocrates, who alludes to it, we find that Pythagoras wrote a complete treatise concerning this plant.[1] Pliny fully describes the mode of preparing a *vinegar of squill* which, according to him, clears the vision, and is good for abdominal pains, but in an overdose destroys life. He also speaks of this preparation and of the *honey of squills*, as useful in dropsies, enlargement of the spleen, and some forms of indigestion. According to him, squill will cure scrofulous and other affections of the skin when applied in cataplasms, etc.[2] Dioscorides attributes to it similar qualities, and further extols vinegar of squill for its

[1] PLINY, Hist. Nat., xix. 30. [2] Hist. Nat., xx. 34, 35.

virtues in healing spongy and ulcerated gums, as a gargle in ulcerated sore throat, and as a stimulant in debility of the digestive organs.[1] The Arabian writers rehearse this catalogue of its virtues, but do not materially augment it.

Action. *On Animals.*—Squill acts poisonously upon various animals. The camel is said to reject it among the plants on which he browses. It is fatal to mice, rabbits, cats, dogs, swine, fowls, etc. In most of these animals it appears to occasion pain with vomiting, great distress, and purging, loss of muscular power, or convulsions.[2] Some experimenters state that it produces inflammation of the stomach, but their opinion seems to be rather an inference from the symptoms, than the result of inspection, for others have met with but few or no traces of phlogosis, and attribute the phenomena produced to the operation of the drug upon the nervous system. The convulsions just alluded to are no doubt produced by the absorption of the active principle of the drug, since they are observed when it is thrown into the cellular tissue of a limb. Emmert and Hoering, who introduced squill into the peritoneal cavity of animals, found that the characteristic symptoms followed.[3] Chiarenti rubbed a solution of squill into the skin of a dog with the effect of producing copious diuresis.[4] The experiments of M. Chateau furnished similar results to those now described, but he found that he was able to produce them with doses of one or two drachms of the medicine, while other observers had employed as many ounces.[5] The following summary includes all of the important toxical effects of squill as observed in dogs. The animals grow dull; then slaver and seem to be nauseated, vomiting follows, with liquid stools which are voided in small portions, and, as it were, drop by drop. If the dose is large, trembling succeeds, and paralysis first of the posterior and then of the anterior limbs. The animals afterward seem to regain their steadiness, but suddenly, and without intermediate symptoms, convulsions take place, or rather a single convulsive paroxysm, which is followed by complete relaxation; the animals fall upon the side, make a few movements like those of deglutition, stretch themselves spasmodically, and die. Schroff performed experiments upon rabbits in which he used alcoholic extracts of squill and also scillitin.[6] The latter occasioned contraction of the pupil, great debility, muscular tremors, sinking of the pulse, diuresis, dulness, oppressed breathing, and death; the former gave rise to similar but less intense phenomena which also ended fatally. After death by scillitin inflammation and erosion of the stomach, and hæmorrhagic transudations about the heart and lungs and in the kidneys and brain, were found.

If the dose of squill is small, these phenomena do not follow one another so rapidly; but they always take place in the same order; that is to say, there is vomiting, then purging, dulness, stupor,

[1] Liv. ii. ch. 167.
[2] WIBMER, Wirkung, etc., v. 20.
[3] STRUMPF, Handbuch, ii. 129.
[4] MÉRAT and DE LENS, vi. 259.
[5] Arch. Gén. de Méd., 5ème sér., iii. 53.
[6] Br. and For. Med.-Chir. Rev., July, 1865, p. 248.

intermittent paralysis, convulsions, and finally death in the course of twelve or fifteen hours. The animal temperature invariably falls during the progress of these symptoms.

In M. Chateau's experiments, the ganglia of the sympathetic nerve were found injected, and sometimes the cerebellum and the spinal marrow were completely softened (?).

The experiments performed with *scillitin*, by M. Marais, presented results identical with those already described; but when the poison was introduced into the cellular tissue instead of into the stomach, the gastro-intestinal symptoms were less decided. Four grains of this substance destroyed a strong dog of medium size within twenty-four hours.[1]

On Man.—The juice of the fresh plant applied to the skin acts as a rubefacient. From the internal use of squill fatal poisoning has sometimes resulted. A case of this sort is recorded by Lange. Quarin even asserts that twelve grains of it may prove fatal. Pregnant women who have used it to produce abortion have perished in consequence. Plenk saw convulsions produced by it in a child. A case is related in which a drachm of the powder was taken to relieve a fit of asthma, but it produced violent and painful vomiting, great prostration, itching and an eruption of the skin, injected face, great heat of the trunk and head, and coldness of the extremities. The result was not, however, fatal.

In general, the effects of an overdose of squill may be thus described. When very excessive, there is violent emeto-catharsis, severe colic, dysury or bloody urine, rapid breathing, a cold skin, coma, and general convulsions. In somewhat smaller doses vomiting and diminished secretion of urine are still the prominent symptoms, and the pulse is found to be less frequent than natural. In small or medicinal doses, squill, in the great majority of cases, exerts a diuretic action, and most frequently at the same time operates on the bowels. But its purgative action is never prominent except at the expense of its action on the kidneys. The characteristic effects seem to be most certainly produced by the powder, or by the wine of squill. The syrup and the oxymel appear to influence the pulmonary secretion more particularly. When used for some time, squill disorders the stomach, destroys the appetite, and impairs the digestive powers.

Squill produces its characteristic effects by absorption through the skin. Brera used it thus successfully in dropsy, as also did Lambert, Lentin, Bally, and Hosse. Krause found that the fresh root reduced to a pulp and applied to the skin, occasioned decided diuresis. Dr. Gerhard[2] applied the powder to the denuded cutis in a case of ascites and in one of anasarca. Copious diuresis occurred in both, and the patients recovered.

Uses. *As an Expectorant.*—Squill is useful in cases of bronchial inflammation of a mild form, when the sputa are tenacious and scanty, and the lungs are free from acute inflammation. Thus it

[1] Annuaire de Thérap., 1857, p. 98. [2] N. Am. and Surg. Journ., x. 157.

will be found serviceable in *chronic bronchitis* complicating emphysema, and in all forms of chronic and subacute catarrh. Under these circumstances it is not usually combined with senega. It is also much employed as an ingredient in the compound syrup of squill, which is so popular a remedy in *spasmodic croup;* but it may be questioned whether the benefits derived from this combination are not chiefly due to the tartar emetic which it contains. In the decline of spasmodic, and even of membranous croup, squill may be of service in promoting secretion from the laryngeal mucous membrane.

As a diuretic, few medicines excel the one under notice, and hence it is in universal use in all the forms of *dropsy.* Even when the effusion is owing to some organic and incurable lesion, it may, nevertheless, be often temporarily evacuated by squill. It is generally prescribed in the passive forms of the disease, or in cases which have passed the acute stage, and ought never to be used so long as the strength and frequency of the pulse and the heat of skin denote inflammatory action, nor when morbid sensibility of the kidneys or of the urinary passages betrays disease in them. Sometimes it produces a rapid evacuation of the water by vomiting and purging; this is particularly the case when it is associated with tartar emetic or with saline cathartics. As a general rule, it is given in combination with digitalis and blue mass or calomel (of each, one grain three or four times a day). In order to lessen its injurious action upon the stomach, it may be conjoined with aromatic tinctures, or with the aromatic spirit of ammonia. A diuretic wine may be composed according to the following formula: ℞.—Tincture of digitalis, fʒij–ʒiij, tincture of squill, f℥ss; compound spirit of juniper, f℥ij; sherry wine, f℥x; acetate of potassium, ℥j.—M. S.—A tablespoonful largely diluted three times a day. When the stomach is intolerant of the medicine, it may be administered endermically, either by friction with its tincture and that of digitalis, or powdered squill may be sprinkled upon the denuded cutis. This latter method is, however, apt to occasion a good deal of pain. In the *hydrocele* of young subjects, says Mr. Waring,[1] a radical cure has occasionally been effected by the local external application of acetum scillæ. It causes desquamation and subsequent absorption of the fluid. It cannot, however, be depended upon even in young persons; in adults it almost always fails.

A salve made with powdered squill was anciently used as a remedy for *warts*, and some modern writers vouch for its efficiency.

Administration.—The *dose* of squill in substance is from *one to three grains* three times a day, and may be gradually increased to *ten or twelve grains.* As a general rule, if it disturbs the stomach or bowels it should be given in smaller quantities, and not combined with opium, which counteracts its influence.

The simple and compound *syrups* are most appropriate as expectorants, in the dose of *one or two fluidrachms.* The *tincture* is most

[1] Manual of Therapeutics, p. 454.

suitable for external application. Its *dose* as an expectorant or diuretic is from *ten to twenty minims.*

CAROTA.—Carrot Seed.

Description.—The fruit of *Daucus carota* (*U. S. Secondary List*). This is a plant of the natural order of Umbelliferæ. It grows wild and is very common both in Europe and in this country, along fences and in neglected fields; the cultivated carrot is a familiar garden vegetable. The root is spindle-shaped, the stalk is divided into erect branches which terminate in compound umbels formed of small, white flowers. The seeds have an aromatic odor, and a warm, pungent, and bitterish taste, which is due to the volatile oil which they contain. The root of the wild carrot is white; that of the cultivated of a reddish-yellow color. The former has a strong smell and acrid taste, due to the presence of a volatile oil; the flavor of the latter is rather sweetish and mucilaginous.

History.—Dioscorides describes the wild carrot under the name of σταφυλῖνος ἀγριος.[1] He states that the seeds promote the menstrual flux and produce abortion, and that they are used as a diuretic in urinary disorders and dropsy. He also mentions that the garden and the wild carrot have similar properties, but that they belong to the latter in a higher degree. This writer, and also Galen, say that the bruised leaves cleanse foul ulcers, and both ascribe aphrodisiac properties to the seeds. Rhazes gives a similar account,[2] and adds that carrots are heating and flatulent unless cooked. He calls them diuretic, laxative, and stomachic.

Uses.—Eberle and other writers state that the seeds are efficient as a diuretic remedy, and much in vogue among the country people, to relieve *strangury* from blisters and other causes, and also suppression of the urine. "They hardly ever fail," says Eberle, "to produce copious diuresis." The volatile oil which they contain renders them rather grateful to the stomach, and hence peculiarly applicable in asthenic forms of *dropsy* connected with dyspepsia.

Externally bruised carrot-root is frequently employed, as in ancient times, on account of its stimulating or cleansing influence upon *foul ulcers.* It was in 1768 that Gibson, in England, applied it to a cancerous sore of the penis, which it greatly amended, neutralizing the smell, and causing a complete separation of the dead parts, and a partial cicatrization of the sore. In other simple gangrenous sores it had the same effect, and promoted the cure.[3] About the same time, Sultzer in Germany, and Bridault and others in France, employed it successfully under like circumstances.[4] Many other writers might be mentioned, including Hufeland, Boyer, and Ricord, to vouch for its admirable qualities in the cases alluded to.[5] We have long been in the habit of prescribing it for all descriptions

[1] Lib. ii. cap. 52.
[2] Ebn Baithar.
[3] Med. Obs. and Inq., iv. 178, 191, 359.
[4] Dict. de Méd., iii. 658.
[5] Dubois, Plantes Usuelles, p. 22.

of *indolent and ill-conditioned sores*, and most successfully for such as have been mentioned, and for those which discharge a thin sanious pus. The juice, used as a wash, is also said to afford great relief to itching in the various *cutaneous affections*.

Administration.—The powdered *seeds* may be given in doses of from *thirty to sixty grains*. An *infusion* may also be made by adding half an ounce or an ounce of them to a pint of water, which may be taken during the day. The root may also be used in simple infusion, but it is more generally employed as an ingredient of broths, which it renders more digestible, and, at the same time, diuretic.

PETROSELINUM.—Parsley Root.

Description.—The root of *Petroselinum sativum* (*U. S. Secondary List*). Parsley is a native of Southern Europe and Asia Minor, but is now everywhere cultivated in civilized countries, for culinary purposes. It is a biennial plant with a white spindle-shaped root, and a jointed stem about two feet high, bearing small white flowers arranged in umbels. The radical leaves are smooth, lobulated, and notched. The seeds are small, ovate, flat on one side, and marked with longitudinal ridges.

History.—Parsley is described by ancient medical writers, and Galen says the plant, and especially its seeds, are stimulant, diuretic, emmenagogue, and carminative. To these qualities Dioscorides adds a discutient influence upon bruises and tumors; he also states that it cures the stings of insects, and some forms of internal poisoning. Similar virtues were attributed to it by the Arabians, who also regarded it as depurative, lithontriptic, capable of arresting or drying up the secretion of milk, as promotive of digestion, etc.

Action.—Parsley has a strong, and to most persons an unpleasant, smell. The seeds are more aromatic than other parts of the plant, and the root has a disagreeable and sweetish taste. The active properties appear to depend upon a heavy, fixed oily product, which has been named *apiol*, and which is obtained only from the seeds. It has their peculiar odor, and is extremely pungent and acrid in taste. It is soluble in alcohol, ether, and chloroform. The action of the seeds resembles that of fennel, anise, or coriander seeds, and is chiefly carminative. The essential oil is poisonous in large doses. According to Mitscherlich,[1] a half ounce of the oil, introduced into a rabbit's stomach, produced laborious breathing, and the expired air smelled strongly of it. The pulse became frequent, and the animal soon grew feeble and unable to stand, and its pupils were contracted. Insensibility, muscular twitches, coldness, and death in five hours succeeded. No lesions of the tissues existed. In doses of from seven to fifteen grains it is represented as occasioning an excitement like that produced by coffee, with warmth

[1] Strumpf, Handbuch, i. 618.

at the pit of the stomach, and a general sense of comfort. Thirty, and from that to sixty grains of this substance produced a state of intoxication, with scintillations before the eyes, deafness, buzzing in the ears, staggering movements, and violent headache.[1]

Uses.—In modern as in ancient times parsley has been used as a *carminative*, *discutient*, and *diuretic*. The root is said to be more actively *diuretic* than the rest of the plant. Eberle states that, given in decoction, it seldom fails to produce a very considerable increase of urine, and that he has employed it to relieve *strangury* from cantharides or turpentine, and the painful micturition depending upon nephritic affections.[2] Chapman makes the same statement.[3] The oil, and also the juice, have been used with good effect in *gonorrhœa*. Tournefort mentions that in Provence the juice is much employed to cure *periodical* fevers; and several others, of whom one of the most recent is Pereira, assert that its powers in such affections cannot be questioned.[4] Still more recently the proximate principle, or the essential oil, has been vaunted as a powerful antiperiodic. The symptoms produced by it, as described above, are thought to be closely analogous to those of quinia, and accounts have been published of its curative virtues in *intermittent fever* and intermittent *neuralgia*, by Joret, Homolle, Dubail, and others.[5] In *amenorrhœa*, *scanty menstruation*, and *dysmenorrhœa*, the efficacy of apiol is very remarkable. The first two authors of those just named remark that, whether the object be to promote the primary establishment of the menses, to restore them when suspended, or to render them abundant when they are scanty and attended with pain in the pelvis, loins, and thighs, no medicine is more worthy of confidence than this. It need hardly be remarked that when the menstrual derangement depends upon constitutional causes these must first be removed by an appropriate treatment, as iron when anæmia is present, purgatives and local depletion when a state of plethora or of uterine congestion exists; nor need it be added that apiol can be of little service if organic changes of the uterus or ovaries form the radical cause of the irregular, defective, or painful performance of the catamenial function.[6] But these cases apart, we have found no medicine so certain in re-establishing the suspended flow or in causing its original appearance where this has been unduly delayed, provided, in most cases, at least, that some indications of a menstrual nisus existed.

Administration.—The powdered seeds may be given in doses of *ten to fifteen* grains. The root should be employed in the recent state, and generally in strong infusion. Apiol may be administered two or three times a day in doses of *five or six drops* inclosed in gelatin capsules.

[1] JORET and HOMOLLE, loc. inf. cit.
[2] Therapeutics, p. 530.
[3] Therapeutics, i. 272.
[4] DUBOIS. Mat. Méd. Indig., p. 166.
[5] Compare JORET and HOMOLLE, Annuaire de Thérap., 1855, p. 180; ibid., 1856, p. 142; Bull. de Thérap., xlviii. 232; Brit. and For. Med.-Chir. Rev., Jan. 1857, p 258.
[6] Consult MAROTTE, Bull. de Thérap., lxv. 295 and 341, for illustrative cases.

TARAXACUM.—DANDELION.

Description.—The root, gathered in the autumn, of *Taraxacum Dens-leonis*, a native plant of Europe, but naturalized in almost every part of the United States. This root is fusiform, brown externally and white within, and abounds in a milky juice. The leaves are radical and serrated or toothed, whence the plant has derived its name of dandelion (dent-de-lion, lion's tooth). The flowers are of a golden-yellow color, composed of imbricated florets, and supported on a fistulous scape. They are succeeded by a hairy radiated pappus, or downy head.

The root should be gathered in the autumn and used while fresh, as its juice is then strongest. The medicinal virtues of the plant appear to depend upon a crystallizable bitter and acrid principle called *taraxacin*.

The following are officinal preparations of taraxacum:—

INFUSUM TARAXACI.—*Infusion of Dandelion.*

Two troyounces of bruised dandelion, in a pint of boiling water, are macerated in a covered vessel for two hours, and strained. Dose, a wineglassful two or three times a day.

A *decoction* may be prepared by adding four ounces of bruised dandelion to a pint and a half of water, boiling to a pint, and straining. Dose, the same as the infusion.

EXTRACTUM TARAXACI.—*Extract of Dandelion.*

This extract is the inspissated juice of dandelion, gathered in September, prepared in vacuo. The dose is one drachm.

EXTRACTUM TARAXACI FLUIDUM.—*Fluid Extract of Dandelion.*

Sixteen troyounces of powdered dandelion are exhausted by alcohol, and the tincture reduced by evaporation to half a pint. *Dose*, one fluidrachm.

History.—As this plant is very abundant in all parts of Europe, it must have been known to ancient physicians, but the name under which it may have been described is uncertain.[1] By Mesue (A. D. 855), and other writers of the Arabian school, it was reputed to be a very efficacious deobstruent and purifier of the blood, and it is for these qualities that it has ever since been employed as a domestic medicine. Towards the close of the last century it enjoyed a professional vogue in consequence of the eulogies lavished upon it by Zimmermann, Van Swieten, Stoll, Hufeland, and Pemberton, as a remedy in chronic affections of the liver and bowels especially, and also in renal calculus, some diseases of the skin, intermittent fever, etc. The general recognition of its diuretic qualities is shown by its popular names of *lectiminga*, *pisse-en-lit*, etc.

Action.—The popular notion of dandelion is that it purifies the blood. Hence its young leaves are very generally eaten as a salad,

[1] STRUMPF, Handbuch, i. 212.

and the unexpanded buds are sometimes pickled. According to Richter, it is of all bitter vegetables the most deobstruent, and as it tends to lessen the crasis of the blood, becomes appropriate when abdominal affections are connected with a febrile movement.[1] The continued use of it is said to enfeeble the digestion and occasion flatulence and diarrhœa, but such effects may very possibly depend upon the decoction or infusion having fermented, which it is extremely apt to do. The general belief, however, is that it is laxative and diuretic. Regarding the former operation some doubt is suggested by cases of Dr. Smyth,[2] in which it appeared rather to confine the bowels.

Uses.—The deobstruent virtues of dandelion have been alluded to. Pemberton particularly recommended it[3] in "incipient scirrhus of the *liver* and also in several *chronic derangements of the stomach.*" Of its utility in the latter case Dr. Chapman was persuaded. This writer also refers to an observation of Rush, that *liver-grown* cattle are speedily relieved by grazing in fields where dandelion abounds. It is indeed favorably spoken of by many authors in affections which are more or less dependent upon hepatic disease, such as hypochondriasis, jaundice, melæna, hæmorrhoids, amenorrhœa, and ascites, particularly when a febrile or irritative condition of the system is present. Dr. Watson, it is true,[4] says, in regard to its use in liver complaints, "It is very doubtful in my mind whether it ever does much good." We may share this doubt as far as regards diseases of an organic nature, but we entertain none in regard to its utility in cases of *dyspepsia* distinguished by obstinate constipation and a scanty or suspended secretion of bile, particularly when these depend upon sedentary habits or mental distress. It was under somewhat analogous circumstances that Wilson Philip strongly advocated its use. In acute dyspepsia, when the symptoms are mild, Dr. Todd advised it to be given associated with nitrate of potassa in some bitter or aromatic infusion.[5]

In *chronic pulmonary affections*, included under the term phthisis by earlier writers, it has been very strongly recommended, and more recently Hufeland included it among the few and only resources to be depended upon in *tubercular consumption.*[6] Even Sir James Clark wrote: "That a course of taraxacum steadily pursued for several weeks during the spring or summer will often produce a very beneficial effect."[7] Indeed, when we consider the close relations of the lungs and liver as regards function, and the fatty degeneration which the latter undergoes in phthisis, we cannot but suspect that a substantial foundation exists for the opinions referred to.

Administration.—Decoction of dandelion may be given in the

[1] Ausfürlich. Arzneim., i. 343.
[2] Lancet, Nov. 1845, p. 506.
[3] Dis. of Abdom. Viscera, 4th ed., p. 42.
[4] Lectures on Practice (1st Am. ed.), p. 750.
[5] Cyclop of Pract. Med., ii. 653.
[6] Médecine Prat. trad. de Jourdan, p. 345.
[7] Cyclop. of Pract. Med., iv. 335.

dose of a *wineglassful* two or three times a day. The dose of the infusion is the same. Both are exceedingly apt to ferment.

The *extract* is often rendered worthless by age. In its recent state the dose is from twenty to sixty grains, given in some aromatic water.

The *fluid extract*, or preserved juice of dandelion, is an excellent preparation. Its dose is *one* or *more fluidrachms.*

ERIGERON.—ERIGERON.

ERIGERON CANADENSE.—CANADA ERIGERON.

Description.—The single term Erigeron is now used to designate the leaves and tops both of E. heterophyllum and of E. Philadelphicum. The former is a biennial and the latter a perennial herbaceous plant; they are two or three feet high, with erect pubescent stems, and ovate lanceolate pubescent leaves supported upon long footstalks; the flowers, which are in terminal irregularly branched corymbs, consist of a disk of yellow florets surrounded by delicate rays of a white or pale-bluish color.

E. Canadense is a larger plant covered with stiff hairs instead of down; its leaves are narrower, and its flowers smaller. Both species are found about old pastures and by the roadside. Fleabane has an agreeable aromatic odor, especially when bruised, and a somewhat astringent, bitter, and feebly acrid taste. These qualities are most strongly marked in Canada fleabane, from which also is extracted an officinal volatile oil (OLEUM ERIGERONTIS CANADENSIS).

EXTRACTUM ERIGERONTIS CANADENSIS FLUIDUM.—*Fluid Extract of Canada Erigeron.*

Sixteen ounces of coarsely powdered Canada Erigeron are treated with alcohol to procure by displacement, etc., a pint of the fluid extract.

Action and Uses.—Almost all of the testimony which has been published respecting the remedial virtues of fleabane agree in attributing to the Canadian species astringent and hæmostatic virtues, and to the Philadelphia species a diuretic action, more particularly. Dr. De Puy, of New York,[1] states that in 1812 it was introduced into the practice of the Hospital of that city, where the extract and tincture were found very efficacious in the treatment of *diarrhœa* and *dysentery*, particularly of the chronic form. The dose of the former used was from one to five grains, and of the latter from two to four fluidrachms. Owing to its action upon the uterus the Indians called it squaw weed. Dr. S. W. Williams states that the oil has proved very efficacious in arresting *uterine hemorrhage*,[2] a statement which has been confirmed by the report of five cases by Dr.

[1] Physico-Med. Trans., vol. i. [2] N. Y. Journ. of Med., vii. 37.

E. Wilson.[1] The discharge was controlled after the administration of the medicine, in doses of five drops every two hours, with a promptness at least as great as that exhibited by any other uterine hæmostatic. A medical friend, however, of large experience in the treatment of diseases of women, informs us that he employed the oil of erigeron in several cases of menorrhagia with so little success that he afterwards abstained from prescribing it.

De Puy found Canada fleabane, when given in decoction or infusion, to operate as a diuretic, and by its means he cured *ascites* as many subsequently have done, including Wistar, Eberle, and W. P. C. Barton. Like other diuretics of its class, it palliates *vesical irritation* from catarrh of the bladder, or strangury from cantharides, and promotes the discharge of sabulous concretions from the urinary passages.

Administration.—An *infusion* of either species may be prepared with an ounce of the plant to a pint of boiling water, and a wineglassful of it given every three hours. A *decoction* has been used, but is less efficient. A *tincture* may be prepared with an ounce of the herb and a pint of alcohol, but is too stimulating; an alcoholic *extract* is preferable, and may be given in doses of about five grains, or the *fluid extract* in the dose of one fluidrachm. The officinal *oil* of Canada fleabane is prescribed in doses of about five drops.

BUCHU.—Buchu.

Description.—The leaves of *Barosma crenata* and other species of Barosma, so called on account of its strong odor (βαρυς, οσμη). This plant, which is a native of the Cape of Good Hope, is a small shrub with brownish branches. The leaves are opposite, ovate, or obovate, and more rarely lanceolate, serrated upon the edges, and on the under surface covered with small glandular points. When dried, and as found in commerce, their surface is smooth and greenish, but the under surface is paler.

The leaves of buchu have a peculiar, strong, and aromatic smell, a bitterish and warm taste resembling that of mint, and, when swallowed, excite a sense of heat in the stomach which diffuses itself over the body. Buchu augments the appetite, promotes digestion, quickens the pulse, favors the secretion of the skin, but still more that of the kidneys, causing a sediment in the urine and giving it an aromatic smell. Large doses produce vomiting and purging. These properties may be attributed to a volatile oil which the leaves contain in the proportion of seven per cent., and which has a strong odor and a very acrid taste, and also to a resinous matter which has been called *diosmin*. Buchu yields its virtues to water and to alcohol.

Extractum Buchu Fluidum.—*Fluid Extract of Buchu.*

From sixteen troyounces of powdered buchu twelve ounces of

[1] Trans. Coll. Phys. Philad., Nov. 1854, p. 330.

tincture are first obtained by percolation with diluted alcohol, and separately, two pints more. The second product is then reduced by evaporation to four fluidounces, mixed with the first portion, and filtered. *Dose*, a fluidrachm.

INFUSUM BUCHU.—*Infusion of Buchu.*

A troyounce of buchu is macerated in a pint of boiling water for two hours in a covered vessel and strained. *Dose*, one or two fluidounces.

History.—This medicine is derived from the Hottentots, who employ the bruised leaves as an application to recent wounds, and prepare with them an ointment which they use to anoint their bodies. They also use a vinous tincture which they procure by distillation, and consider a sovereign remedy for all chronic disorders of the stomach and bladder.[1] From them the Dutch settlers at the Cape learned the virtues of the plant, and carried a knowledge of them to Holland, whence they first became known to the rest of Europe. In 1821, Dr. Reece published an account of it in England. It was generally employed then as now for dyspepsia, and renal or vesical affections attended with unhealthy muco-purulent secretions.

Uses.—It is chiefly in *chronic affections of the genito-urinary mucous membrane*, accompanied with an altered secretion, that buchu is prescribed, and these it frequently cures completely if they are independent of textural alterations. Thus it is often successful in putting a stop to the undue secretion of the mucous follicles of the urethra, the vesiculæ seminales, or of the prostate, produced by excessive venery or by a habit of self-pollution. But its benefits are still more decided in those cases of catarrh of the bladder which have supervened upon gonorrhœa, or upon the improper use of irritating injections. This affection, which often extends to the ureters, and may involve, even to disorganization, the kidneys themselves, producing great pain, muco-purulent discharge, incontinence or retention of urine, etc., is very successfully combated by the infusion or the fluid extract of buchu.[2] Clarus relates a case of gleet of three years' standing which was cured in a month by the infusion of buchu;[3] and Sir B. Brodie states that he has seen it productive of the most beneficial effects in urinary disorders depending upon disease of the kidneys.

The tonic properties of the medicine make it an appropriate remedy in cases of urinary disease connected with *atonic dyspepsia*. It tends to prevent mal-assimilation of the food and the consequent generation of sedimentary deposits in the urine, while its diuretic property holds the latter in solution, and favors their discharge. *Incontinence of urine*, depending upon irritability of the neck of the bladder, is sometimes relieved by it. Some forms of *dropsy*, and particulary idiopathic anasarca, have been cured by its means.

[1] SIGMOND, Lectures, Lancet, 1837–8, ii. 828.
[2] MCDOWELL, Med.-Chir. Rev., vi. 485.
[3] Arzneimittel., p. 358.

Rheumatism and rheumatic *gout*, and chronic *skin diseases*, are said to have been benefited by this remedy, which has also been used with apparent advantage in *dysmenorrhœa*, *leucorrhœa*, *amenorrhœa*, *uterine hemorrhage* after delivery, and in some cases of *suppressed menstruation*.

Administration.—Buchu is seldom given in substance, but the dose of its powder may be stated at *twenty or thirty grains*. The *infusion* is its ordinary form, and is directed in doses of from one to two ounces. The *fluid extract* may be prescribed in doses of a fluidrachm. A useful infusion is that made with uva ursi, as follows: ℞.—Buchu, uvæ ursi, āā ʒj–ʒiv; hot water, Oj. Digest for half an hour in a covered vessel, and strain. *Dose*, from *half a fluidounce to two fluidounces* every two or three hours.

UVA URSI.—Uva Ursi.

Description.—Arctostaphylos Uva Ursi, or *bearberry*, is an evergreen, creeping shrub, which grows in open barren places, and in woods, and on mountains, in nearly every part of Europe, but most abundantly in northern latitudes. In America it is found throughout Canada, and as far southward as New Jersey. The leaves, which are the officinal portion of the plant, are obovate, thick, coriaceous, smooth, shining, of a deep-green color above, and on their under surface paler, and covered with a network of veins. The fruit is a red glossy berry, containing an insipid pulp and five seeds.

The taste of the leaves is at first styptic, but afterwards pleasantly bitter and somewhat sweetish, exciting a copious flow of saliva. The bark of the stem is even more astringent than the leaves, but the woody fibre is insipid. The odor of the dried leaves has been compared to that of hay, and also to that of liquorice. The astringency of the plant is chiefly due the presence of gallic and tannic acids, which attack iron or its salts added to an infusion of the leaves. A volatile oil, bitter extractive, a crystallizable principle called *ursin*, possessed of diuretic properties, and another called *arbutin*, have been obtained from this plant.

Decoctum Uvæ Ursi.—*Decoction of Uva Ursi.*

This decoction is made with a troyounce of uva ursi boiled in a pint of water for fifteen minutes, strained, and sufficient water added through the strainer to make a pint. *Dose*, one or two fluidounces three or four times a day.

Extractum Uvæ Ursi Fluidum.—*Fluid Extract of Uva Ursi.*

From sixteen troyounces of powdered uva ursi half a pint of tincture is first obtained by percolation with diluted alcohol, and afterwards and separately two pints and a half more. The second product is reduced by evaporation in a water bath to four fluidounces, and eight troyounces of sugar added to it while hot. It is then

mixed with the reserved tincture, strained, and by a gentle heat evaporated to a pint. *Dose*, a fluidrachm.

History.—It is uncertain whether this plant was known to the ancients. In modern practice it would seem to have been first employed by Spanish and Italian physicians, who used it in calculous complaints about 1730–40. Its more general adoption dates from the writings of DeHaen in 1756, and of Murray in 1764.

Action.—Uva ursi appears to promote the appetite and confine the bowels when given in small doses; in large quantities it has caused vomiting and purging. It does not display a very evident diuretic operation in a healthy state of the system, but in calculous disorders the urine appears to augment under its influence. Its astringent principle passes off with this secretion, giving it a dark color.

Uses. *Diseases of the Urinary Organs.*—Murray recommended uva ursi in various cases of disease of these parts attended with a mucous, bloody, or purulent discharge, with painful micturition, or partial paralysis of the bladder.[1] He held that it caused the expulsion of calculi by augmenting the urine, and that it contributed to blunt the sensibility of the mucous coat of the bladder to the irritation of its contents, to cure chronic catarrhs of the urinary passages, and at the same time to diminish the pain and the frequency of urination. De Haen says: "Persons who suffer from prolonged, obstinate, and copious suppuration of the urinary organs, without venereal taint and without evident signs of stone, are cured, and that permanently, by uva ursi alone." Even in calculous cases, he remarks, "the symptoms are often so completely palliated that pain in passing the urine or in retaining it is no longer experienced. In other cases of apparent cure the relapses have been cured by the same means, and that repeatedly. In other instances again the unfavorable condition of the patient prevented any improvement."[2] According to Prout, it greatly palliates the symptoms, and Sir B. Brodie employed it with marked advantage in irritable states of the bladder, particularly when dependent upon disease of the kidney.[3] Clarus saw excellent results from its use in these affections.[4] Ferriar[5] gave it in a considerable number of nephritic cases, and always with manifest advantage. His method was to prescribe a saline purge twice a week, and on each of the intermediate days to administer five grains of powdered uva ursi, with half a grain of opium, three or four times a day. He never found larger doses necessary, and in twelve out of sixteen cases obtained permanent relief from pain. Eberle[6] alludes to a case of renal calculus in which this medicine, as prescribed by Ferriar, appeared gradually to remove all symptoms of the disease. Barton testified to its usefulness

[1] Apparat. Med., ii. 76.
[2] Bull. de Thérap., xlvii. 507. See, also, Med. Museum, i. 15, 89, 601, and ii. 335.
[3] WARING, Manual of Thérap., p. 526.
[4] Arzneimittel., p. 282.
[5] Medical Histories (Am. ed.), p. 56.
[6] Therapeutics, p. 564.

during the nephritic paroxysm in his own person. Indeed, nearly all in whose hands the remedy has been successful are very emphatic in its commendation, while they insist upon its long-continued use as essential to accomplish a cure, and do not advise a resort to it when there is active inflammation of the urinary organs.

The late Dr. Gilbert informed us that he was long in the habit of preventing *strangury* from blisters of cantharides by administering twenty grains of powdered uva ursi when the blister is applied.

In some cases of *dropsy* uva ursi has proved a useful medicine. Such were probably of an atonic character, and maintained by feebleness of the digestion as well as general laxity of fibre.

This medicine was very early proposed as a remedy for *consumption*, but Murray states that experience had proved nothing in favor of its presumed efficacy in "purulent phthisis," by which term we must understand *chronic bronchitis.* Dr. Bourne, of Oxford, wrote a work,[1] to prove its value in "pulmonary consumption," but describes his cases as being of "apparently true pulmonary consumption," so that we may reasonably doubt their having been tuberculous. They seem to show that the medicine decidedly moderated the purulent secretion of the bronchia, and diminished hectic symptoms in the same proportion. He prescribed it in powder, and in doses of five grains or more three times a day.

It is asserted by Dr. Harris, of Fayette, Ala., like ergot, to possess the property of causing contraction of the gravid uterus,[2] and the statement has been repeated by Beauvais and Gauchet in France.[3]

Administration.—The dose of *powdered* uva ursi is generally stated to be from *twenty* to *sixty grains*, and the remark is often made that it soon excites extreme disgust. The reader will have observed that the dose which proved so successful in the hands of De Haen and of Ferriar were much smaller, and did not exceed *five grains.* The *decoction*, which is officinal, is more generally employed, in the dose of *half a wineglassful* or more three or four times a day. The *fluid extract* may be given in doses of a *fluidrachm* two or three times a day.

CHIMAPHILA.—Pipsissewa.

Description.—Chimaphila umbellata, pipsissewa, or wintergreen (χειμα, winter, and φιλος, friend), is found in the northern countries of Europe and Asia, but more abundantly in the United States. It is a humble shrub of not more than from three to six inches in height, with lanceolate, serrated, dark-green, and coriaceous leaves in irregular whorls, and bearing white flowers tinged with red. The root is long, creeping, and yellowish. All parts

[1] Cases of Pulmonary Consumption, etc., treated with Uva Ursi. 1805.
[2] Charleston Journ., ix. 117.
[3] Bull. de Thérap., lvi. 528.

of the plant are medicinal, but the leaves only are officinal. When fresh, they exhale a fragrant odor, which they lose on drying. Their taste is bitterish, astringent, and sweetish, and the roots and stems have, in addition, a marked pungency.

DECOCTUM CHIMAPHILÆ.—*Decoction of Pipsissewa.*
It is prepared by boiling a troyounce of bruised pipsissewa in a pint of water for fifteen minutes, straining, and adding sufficient water to make the decoction measure a pint. *Dose*, two fluid-ounces.

EXTRACTUM CHIMAPHILÆ FLUIDUM.—*Fluid Extract of Pipsissewa.*
Sixteen ounces of pipsissewa in moderately fine powder are used with alcohol, glycerin, and water to prepare this fluid extract.

History.—This plant was long in use among the aborigines of this country, and through them it became a popular domestic remedy. It was noticed by Schoepf, who described it as astringent and tonic; but the first detailed account of its properties is contained in the inaugural dissertation of Dr. Mitchell at the University of Pennsylvania in 1803. Less attention, however, was attracted by this essay than by a paper of Dr. Somerville, referred to below, and which was published in 1814. From the latter date the medicine has been extensively employed, and its virtues are now generally recognized.

Action.—The bruised leaves sometimes produce redness, and even vesication, when applied to the skin, as Dr. B. S. Barton first observed. Internally, the plant is diuretic, tonic, and astringent. According to Somerville,[1] its diuretic virtues are indicated by the name *l'herbe à pisser*, which the French Canadians gave to it. This writer, who observed them himself very unequivocally in several cases, says, "it generally increases the secretion of urine, and retains its influence on the kidneys for some time; it occasionally acts as a tonic, and in all cases is free from those offensive, and even deleterious, qualities which frequently interdict the application of some of the most powerful diuretics." Like uva ursi, it imparts a dark color to the urine, particularly when given in decoction or infusion. This effect is due to the tannin it contains. In other respects, too, it so closely resembles uva ursi, that the one medicine may be substituted for the other; but wintergreen is more acceptable to the stomach.

Uses.—Dr. Somerville found chimaphila very useful as a diuretic evacuant in several cases of *dropsy* which appear to have depended upon organic and incurable lesions, and he refers to similar cases which were treated by Satterley and Marcet. Chapman regarded it as distinguished for the activity and certainty of its diuretic operation, while it acted upon the stomach as a tonic.[2] Direct experience, and the inferences allowable from the physiological action of the medicine, seem to point to cases of atonic and cachectic

[1] Med.-Chir. Trans., v. 347.
[2] Therapeutics, i. 299.

dropsy as the most suitable for its employment. But there is very little evidence to be found of its possessing curative powers of a high order.

Chimaphila was used by the aborigines and early settlers of America as a remedy for *rheumatism* and for *nephritic disorders*. The former applied the bruised leaves to the affected joints, while they administered a hot decoction of the plant, so as to excite profuse perspiration. They were also in the habit of using it for all disorders in which the secretion of urine is diminished. Ives says:[1] "It will be granted by all who are familiar with its operation, that as a diuretic it has unquestionable merit, and that, like *uva ursi*, it will frequently mitigate symptoms of gravel, and strangury proceeding from other causes. I have given it, alternately with uva ursi, in *hæmaturia*, the effect of severe and long-continued gonorrhœal inflammation, with the most obvious benefit."

According to Chapman, its reputation for usefulness in *scrofula* is such as to have gained for it the provincial title of the "king's cure." This writer states that it is best suited to open scrofulous *ulcers*, for which the decoction may be used internally, and also externally as a wash. It is sometimes employed as a domestic remedy for the same disease. Ives states that in some instances it has appeared to be of service in chronic *cutaneous eruptions*. It has also been used successfully in the treatment of *intermittent fever*, of *chronic diarrhœa*, *leucorrhœa*, and *gleet*.

Administration.—The best form of this medicine is the officinal *decoction*, of which *a pint* may be given in the twenty-four hours. A fermented decoction is also used as a diet drink.

JUNIPERUS.—JUNIPER.

Description.—Juniper is the fruit of *Juniperus communis*. This shrub is a native of Europe, but has been naturalized in America. It is an evergreen, and where it grows in rocky soils and hilly situations is of low stature, but in warmer and more genial localities reaches twelve or fifteen feet in height. The branches are close, the leaves narrow, sharp, channelled, and of a deep-green color. The fruit (*galbulus*) is a fleshy berry, of the size of a small pea, of a dark-purplish color, covered with a greenish bloom, and containing three angular seeds. Their taste is sweetish, bitter, and aromatic. The whole plant diffuses a strong but agreeable odor, which it derives from its essential oil, and which has led to its being used to fumigate ill-smelling places. This oil is most abundant in the berries when they are upon the point of ripening. Later than this, it is converted more or less completely into a resin. The tops may be used for the same purposes as the berries.

INFUSUM JUNIPERI.—*Infusion of Juniper.*

To a troyounce of bruised juniper berries a pint of boiling water

[1] PARIS's Pharmacologia (3d Am. ed.), ii. 283.

is added, infused for an hour in a covered vessel, and strained. Dose, two or three fluidounces.

SPIRITUS JUNIPERI COMPOSITUS.—*Compound Spirit of Juniper.* This preparation is made by dissolving oil of juniper a fluidrachm and a half, and oil of caraway and oil of fennel each ten minims, in five pints of alcohol, and adding three pints of water. Dose, from two to four fluidrachms. It is an appropriate addition to the infusion of juniper, and that of other stimulant diuretics.

History.—It is probable that this medicine was known to ancient physicians, but the name under which it was described by them is now only a matter of conjecture.

Action. *On Animals.*—Some experiments by Semon upon rabbits with oil of juniper, gave the following results:[1] An ounce destroyed a vigorous rabbit in about twenty hours, and the odor of the animal's secretions proved that the oil had been absorbed. The symptoms produced resembled those from oil of turpentine. The heart beat quicker and harder and then by degrees more feebly; the breathing grew more rapid and labored; there was diuresis and diarrhœa, and finally death by exhaustion. The bowels and kidneys exhibited a congested state, but no inflammation.

On Man.—Juniper is stomachic and carminative, in virtue, probably, of its volatile oil and resin, and is found to stimulate the appetite and digestion. In large doses it is said to quicken the circulation, and at the same time to augment the cutaneous transpiration and the urine, to the latter of which it gives, like turpentine, an odor of violets. According to Alexander, the oil of Juniper is a very active diuretic.[2] The specific operation of the powdered berries upon the kidneys is so decided that their continued employment has occasioned bloody urine.[3] They are also reputed to possess emmenagogue properties. Oil of juniper applied to the skin, and allowed to evaporate, produces a slight and transient redness, but no vesication; but it is apt to blister if prevented from evaporating.

Uses.—Juniper augments the urine, and acts as a healthful stimulant in chronic affections of the *bladder*, and particularly when the tone of this organ is impaired, inducing retention of urine. In chronic *vesical catarrh*, and in *gonorrhœa* and *gleet*, it has been used with success. Its advantages are particularly apparent when the *urine* as well as the cutaneous transpiration are *diminished by cold*, or by inactive or *sluggish habits* of life. Under these circumstances, according to Richter,[4] it prevents the development of cutaneous eruptions, and of abdominal derangements which may eventuate in organic disease. Its diuretic and healing qualities become very useful in cases where *sabulous matter* and small calculi are passed with difficulty, or create by their presence a mucous or purulent secretion from the urinary passages.

[1] MITSCHERLICH, Lehrbuch, ii. 266.
[2] Experimental Essays, p. 151.
[3] PISO, in MURRAY, App. Med., i. 47.
[4] Ausfürlich. Arzneim., ii. 108.

Several writers have extolled juniper in *dropsy*. Richter praised it especially in *scarlatinous* dropsy; and Van Swieten says[1] that he often found a strong infusion of the berries to suffice for the cure of *ascites* or *anasarca*, when the disease was not quite inveterate. But, he adds that it should be made with a large quantity of the berries, as the body easily bears this remedy. The late Dr. Otto was in the habit of using the following prescription with success, and we can testify to its efficacy: Take half an ounce of bruised juniper berries, half an ounce of cream of tartar, and a pint of boiling water. Make an infusion to be taken at intervals during the twenty-four hours. The acetate of potash may be substituted for the bitartrate in one-half the dose. Other diuretic mixtures and infusions, of which juniper forms an active ingredient, are given in the formularies. In *scurvy*, the infusion is reputed to be serviceable, and is much used by the people as a "purifier of the blood."

As an *external* application to *painful swellings*, and for *local pains* generally, poultices containing bruised juniper berries are much used in Europe. *Fumigations* made by throwing the berries or shavings of the wood upon hot coals are also employed to assuage pain and promote perspiration in *rheumatism*.

Administration.—A pint of the *infusion* prepared as already directed may be taken in the course of twenty-four hours. Other diuretics can be added to it if necessary, such as the salines referred to above, or parsley, buchu, horseradish, etc., or the berries may be introduced into a hot decoction of chimaphila, broom, etc. The *oil of juniper* (OLEUM JUNIPERI) is more stimulant than the infusion, and may be associated with various diuretic medicines in the atonic forms of dropsy. It is often used in the form of Holland gin, to which it imparts its peculiar flavor and diuretic qualities. The dose is from *five* to *fifteen* or *more drops*. The *compound spirit of juniper* is used for the same purposes as the oil, in doses from *two* to *four fluidrachms*.

OLEUM CADINUM.—*Oil of Cade. Huile de Cade.*

This is an empyreumatic oil, obtained by the dry distillation of juniper wood (*Juniperus oxycedrus*). It is a brownish, syrupy fluid, with a strong odor of tar, and a disagreeable, acrid, and burning taste. It does not irritate the sound skin, but its application to ulcerated surfaces is painful and irritating. It is manufactured in the South of France, where it is much used by farmers in treating the skin diseases of their cattle. It was introduced into medical practice by M. Serres (d'Alais), and fully tested by Dévergie, in various diseases of the skin.[2] It would appear that the purity of the preparation is essential to its succesful use, and, at the same time, that it is seldom to be found pure. The diseases in which it has been mainly curative are *chronic eczema* and *psoriasis*, after the complete disappearance of the acute symptoms, and in *lupus*, for

[1] Commentaires, § 1243.

[2] Bull. de Thérap., xxxvi. 104, and xxxiv. 49; DEVERGIE, Maladies de la Peau, p. 111, and p. 255.

which it may be used as an adjuvant to internal means. Dr. Chapin employed this oil with striking advantage in *sycosis*, *eczema*, *impetigo*, and *ichthyosis*. The following formula is that which he considered the best: ℞.—Oil of cade, f℥ij; glycerin, f℥v; solution of subacetate of lead, f℥j.—M. S.—To be rubbed over the affected part every night. When the disease affects a large surface, a mixture of one part of oil of cade to seven or eight parts of cod-liver oil, or lard oil, may be substituted for the glycerin compound.[1]

The oil is sometimes applied pure, and in that case the slightest possible film is laid upon the affected part, but not oftener than once in from two to four or five days. This mode of application is the best, but if an ointment is preferred, it may be made as above described, or according to Dr. Erasmus Wilson's formula: ℞.—Oil of cade, ℥j; suet, ʒvj; lard, ʒij. Melt with a gentle heat to make an ointment.

COPAIBA.—Copaiba.

Description.—Copaiba is the oleo-resin of *Copaifera multijuga* and other species of Copaifera, which grow in Brazil. The former is described as a lofty and elegant tree with a dense canopy of foliage. The leaflets are in pairs of from two to ten, and are more or less elliptical in shape. The flowers are whitish and in terminal branched spikes. The fruit is an oval pod containing a single seed.

The juice, which is exceedingly abundant, is obtained by means of incisions made in the stems of the tree. It is a clear transparent liquid, of an amber color, and of about the consistence of olive oil. Its odor is aromatic, and at first rather pleasant; the taste is hot, bitter, and nauseous. It is insoluble in water, but dissolves entirely in ether, alcohol, oils, and strong alkaline solutions. It forms with alkalies, a kind of soap which is insoluble in water. With one-sixteenth of its weight of magnesia, it forms a solid mass which has been used to form pills. It consists of about forty-five per cent. of resin, or copaivic acid, and about thirty-four per cent. of volatile oil, according to its age and exposure to oxidation in the air. The oil, when perfectly fresh, is colorless, but becomes greenish by being kept. It is soluble in alcohol.

The officinal preparations of copaiba are these:—

Oleum Copaibæ.—*Oil of Copaiba.*

This oil is procured by the distillation of copaiba and water. Dose, ten or fifteen drops.

Pilulæ Copaibæ.—*Pills of Copaiba.*

Two troyounces of copaiba are mixed with sixty grains of magnesia, and set aside to concrete, when it is divided into two hundred pills. They ultimately become quite brittle.

[1] Boston Med. and Surg. Journ., April, 1859, p. 215.

History.—The earliest account of copaiba is that which was furnished by Piso, in 1648. This writer says that it cures leucorrhœa, diarrhœa, and gonorrhœa, and he refers to injections of it in the last-named disease. Marcgrave, who wrote at the same period, speaks of its virtues in dysentery, and other intestinal fluxes. Morton (1720) included it among the balsamic medicines proper in consumption. From this time to that of Hunter, this medicine seems to have been more used for the treatment of bronchial affections than of gonorrhœa, but at the present day it is universally prescribed for the latter disease, and is regarded in the light of a specific for its cure. Even Hunter was far from appreciating its value, for while admitting that it lessens the disposition of the parts to form matter, he asserts that, "not having at the same time the power of lessening the inflammation, it can be of little service."[1]

Action.—The operation of copaiba, according to Ricord, who has most completely investigated the subject, takes place upon the stomach, the bowels, the urinary apparatus, and the skin, and in some rare cases upon the nervous centres.[2] Upon the stomach it shows its action by gradually impairing the appetite, exciting eructations with the characteristic smell and taste of the drug, or else nausea, retching, and even vomiting, with gastric distress. When it disagrees with the stomach, it is apt at the same time to purge. Upon the urinary organs its influence is more uniform and more evident. It augments somewhat the quantity of this secretion and imparts to it a deeper color, a bitter taste, and a peculiar smell, which is rather fragrant. On standing, its surface is apt to be covered with an iridescent pellicle, and it becomes turbid from the presence of resinous matter, which may be distinguished from albumen by its not readily subsiding, as well as by its not answering to the tests for the latter substance. The urine of persons taking copaiba will usually give a precipitate with nitric acid, which has caused it to be supposed albuminous. It is, however, soluble in alcohol, which renders albumen still more insoluble. When the dose has been unduly large, it occasions some heat and tenesmus in urinating, as well as a frequent desire to pass water, and even hæmaturia, and, at the same time, a feverish excitement of the whole system, fulness and frequency of the pulse, headache, and thirst.

Copaiba is evidently absorbed into the general circulation. This is clearly proved by the characteristic odor which it gives to the breath, by its modification of the urine, by its action upon the skin, and by its influence upon bronchial inflammations. It is asserted by Ricord that when it produces cutaneous eruptions its operation on the urinary passages is very slight. These eruptions were first noticed in 1814, by Montégre, who described certain red spots as appearing upon the skin whenever the urethral discharge was suspended. Delpech noticed a miliary eruption connected with

[1] Works, Amer. edit., ii. 80.

[2] A Treatise on the Venereal Disease, by John Hunter, etc., Am. ed., 1853.

gastric disturbance.[1] Armstrong also observed itching and an eruption of the skin produced by copaiba.[2] In 1828 Dr. Hewson, of Philadelphia, published a notice of several such cases. In two of them the eruption resembled urticaria, and in two others it had the characters of roseola.[3] Mr. Judd has also described "a puniceous eruption," and one of maculæ, and Desruelles observed urticaria proceeding from this cause. These eruptions are most apt to occur when the medicine disagrees with the stomach, and they indicate that it is no longer acting favorably upon the disease. Indeed, Ricord states that it is not uncommon to see patients in whom the running, after having been dried up, reappears along with the cutaneous eruption.

As regards the action of copaiba upon the nervous system, it may be stated that Ricord met with cases in which too large a dose, or the untimely administration of the medicine, occasioned alarming symptoms. In one temporary hemiplegia was produced, which ceased upon the occurrence of a rubeoloid eruption; and in another an attack of convulsions terminated in like manner. Maestri observed a case in which large doses of copaiba produced rigidity of the muscles of the trunk, and partial paralysis of the facial muscles.[4]

Oil of copaiba acts very much as copaiba itself, but less powerfully. According to Mitscherlich, it is poisonous to rabbits in doses of an ounce or more. The symptoms produced by it are hurried breathing, and palpitation of the heart, restlessness, frequent micturition, loose alvine discharges, which at last become mucous and bloody, and at last death by asthenia. The gastro-intestinal mucous membrane after death does not exhibit inflammation, but only a partial destruction of the epithelium. Upon the human skin this oil acts very feebly as an irritant. When taken internally it is excreted with the urine, from which it may be precipitated by nitric or muriatic acid.

Uses. *Gonorrhœa.*—As already noticed, the use of copaiba in gonorrhœa dates from the introduction of the medicine into Europe, and seems to have been borrowed from the natives of South America. But it was first brought into more general use in the last century by Hunter and by Swediaur. The method of these physicians was not calculated to abridge very much the duration of the disease, for they employed the remedy very seldom before the natural period of its decline. In this, too, Cullen agreed with them,[5] and the greater number of English practitioners of the present day adopt the same temporizing method. It undoubtedly succeeds, but only by a tedious cure. A different method is generally to be preferred whenever the inflammatory symptoms are not severe. In 1804 a patient of Ribes, of Paris, took by mistake an ounce of copaiba at a single dose. He was purged, suffered colic and loss of appetite, but the gonorrhœa he labored under was cured.

[1] BAYLE, Bibl. de Thérap., l. 355.
[2] On Fevers, Am. ed., p. 474.
[3] N. Amer. Med. and Surg. Journ., v. 72
[4] Prag. Viert., lxii. Anal 98.
[5] Mat. Med., ii. 192.

In 1812 Ansiaux adopted the plan of giving Chopart's mixture[1] from the very beginning of the attack, and found that it often produced a speedy cure.[2] In English medicine the first trace of the new method is contained in the writings of Armstrong (1818), who states that he adopted it on the suggestion of Dr. Dawson, who had followed it for several years. Armstrong employed the remedy in the very first stage of virulent gonorrhœa, and he concluded from his own experience that it would not fail once in twenty times completely to arrest the progress of the disease, provided it were given in sufficient doses, and continued for several days after the cessation of the discharge. Subsequently, Delpech[3] (1822) directed that, after reducing the inflammation, if necessary, by local and general depletion, a drachm of copaiba should be given night and morning, increasing the dose gradually to twice this quantity three times a day, and adding opium to it if it purged. Ricord adopted the same plan, and carried the dose when necessary and if it could be tolerated, even to an ounce in twenty-four hours. Clarus, in Germany, pursued a somewhat more cautious method. In the beginning of the attack he prescribed a weak emulsion (ʒj to ℥vj), gradually increased the proportion of copaiba to ʒiij, and then gave it pure in doses of from twenty to forty drops three times a day.[4] Objections have been brought against the large doses recommended above. They are said to have produced great inconvenience by causing an irritable and even an inflammatory condition of the bladder. Something of this we have witnessed, as well as pain in the region of the kidneys, but are disposed to regard it as unusual, and as not forming a valid objection to a plan which, when successful, so remarkably abridges the disease for which it is given. It is important, if possible, to commence the treatment in the very forming stage of the attack, for then it can generally be arrested; next, it should not be employed in cases of an inflammatory type without previous antiphlogistic measures; and, again, the medicine should be continued, and gradually diminished in quantity, for several days after the running has ceased.

The results here stated throw light upon the mode in which copaiba effects a cure. Its mode of action seems to be that of substitution. It excites in the diseased mucous membrane, over which it passes, mixed with urine, an action which is inconsistent with the original morbid process. Cullen long ago said of the cure of gleets, "I am persuaded that turpentine, or, what is much the same, the balsam copaivæ, operates only by inducing some degree of inflammation upon the urethra,"[5] and Mr. Headland, in the most recent work on the action of medicines,[6] remarks that it cures by stimulating the glands, and increasing the healthy function to dis-

[1] ℞.—Mint-water, alcohol, copaiba, syrup, āā ℥ij; spirit of nitric ether, ℥j; orange-flower water, ʒij.—M. S.—Two tablespoonfuls in the morning, one at noon, and one at night; and continue for twelve days.

[2] Dict. de Méd. en 60 vol., vi. 240.

[3] Bib. de Thérap., i. 371.

[4] Arzneimittellehre, p. 758.

[5] Mat. Med., ii. 182.

[6] On the Action of Medicines, p. 255.

place the morbid one. It is only in this manner that the effects of the remedy can be explained. Otherwise we must regard it as a specific, which is unnecessary, or like Giacomini, as a sedative, which is absurd.

It is because the active principles of copaiba are excreted with the urine that we are enabled with comparative ease to cure gonorrhœa. This has been proved by a conclusive experiment. Three cases of the disease occurring in persons affected with hypospadias came under the care of M. Ricord. The purulent secretion flowed from the urethra, in the portion anterior to the accidental opening, as well as from that behind it. But the administration of copaiba cured the latter, without relieving the former until the medicated urine was made to pass through the whole length of the urethra, when the discharge in the anterior portion likewise ceased. This interesting experiment explains why it is that in females vaginal gonorrhœa is so much more difficult to cure than urethral; for in the former the copaiba does not come directly in contact with the diseased parts. Some experiments have been tried to cure the disease by injecting emulsions of copaiba into the urethra, as Piso did two hundred years ago; but they have usually failed because, probably, the urine remains unmodified, and irritates the inflamed part in its discharge. Marchal made use of injections of the pure balsam and of an emulsion containing it, and of bougies smeared with it. His success does not appear to have been very great.[1] Mr. Dallas, of Odessa, used several times a day injections of the following emulsion: ℞.—Copaiba, ʒv; yelk of egg, No. j; extract of opium, gr. j; water, ℥vij; and is stated to have employed it, without any other remedy, with complete success.[2]

The disgust which patients are apt to acquire for copaiba led Velpeau to try its administration by the *rectum.* He used it in doses of two drachms at first, which were gradually increased to six drachms, made into an emulsion with a small proportion of laudanum added, taking care that the bulk of each dose should not be sufficient to induce its expulsion, or to cause burning by its contact with the anus. The treatment was successful in nearly all of the cases, but neither so speedily nor so often as the ordinary one.[3] Ricord admitted the occasional efficacy of this method, but affirmed that the medicine is ten times more certain to cure when given by the mouth. Ratier used, instead of injections, copaiba capsules introduced into the rectum beyond the sphincter, after well anointing the part.

Numerous authors, including Hoffmann, Bretonneau, Barbier, Delpech, and Dr. La Roche, have found copaiba very serviceable in the treatment of *vesical catarrh.* According to Dr. La Roche,[4] moderate doses are the most successful, because they agree better with the stomach, and can be continued for a longer time. He

[1] RANKING's Abstract (Am. ed.), xv. 166.
[2] Brit. and For. Med.-Chir. Rev., July, 1856, p. 265.
[3] Bibl. de Thérap., i. 383.
[4] Am. Journ. of Med. Sci., iv. 13.

also advised that the medicine should be occasionally suspended, in order to allow the stomach an opportunity of recruiting, and to prevent the risk of too constant an irritation of the affected parts. Other physicians (Souchier, Dévergie, Pidoux) employed injections of copaiba into the bladder in these cases, even to the extent of two ounces, with a like quantity of barley-water, and, as it would seem, successfully.[1] This medicine has occasionally been used with advantage in *hæmaturia* dependent upon inflammation of the bladder.

Some writers have thought that copaiba when given freely disposes to *hernia humoralis;* but Ribes asserts, on the contrary, that nothing so soon reduces engorgement of the testicle, and that its use renders quite unnecessary all local applications, and even a suspensory bandage. Delpech made a similar observation. Although these results, and some general considerations that might be adduced, seem to favor the method, it does not appear to have been much employed, perhaps because it seemed more hazardous than it really is. Armstrong[2] found copaiba very beneficial in some cases of simple *leucorrhœa*, that is, of leucorrhœa uncomplicated with disease of the uterus or its appendages. Mitscherlich expresses a similar opinion, and Dr. La Roche furnished several cases which sustain this favorable judgment. Dr. Churchill,[3] on the other hand, states that it did not succeed in the cases in which he tried it. In ulcerated *hæmorrhoids* it has been recommended by Cullen and Bell.

Next to its virtues in the cure of gonorrhœa, the power of copaiba over certain *bronchial affections* is the most remarkable. This, in fact, was one of the virtues earliest assigned to it, and several writers recommended it in consumption, including in that term the diseases now referred to. Fothergill was one of the first (1769) to point out its injurious effects in consumptions attended with *bloody and purulent expectoration*,[4] meaning thereby cases of pulmonary tubercles. Other writers of the same, or the immediately subsequent period, among whom Hoffmann, Valcarengh, and Monroe may be mentioned, speak highly of its benefits in chronic pulmonary affections. In 1809, Hallé pointed out the curative properties of copaiba in chronic bronchitis, which he well distinguished from tubercular consumption.[5] In 1818, Armstrong[6] held it to exert a specific influence over chronic inflammation of the mucous membrane of the trachea and bronchia. He gave large doses, such as from thirty to eighty drops three times a day. This writer also alludes to, and commends, a favorite remedy of Morgagni in chronic complaints of the lungs, and which consisted of copaiba combined with sulphur. In 1827, Dr. La Roche, of Philadelphia,[7] in an essay which is valuable for its practical observations, demonstrates clearly the great advantages of this medicine in chronic bronchial inflamma-

[1] TROUSSEAU and PIDOUX, Thérap., ii. 619.
[2] Practical Illustrations, etc. (Am. ed.), p. 558.
[3] Diseases of Females (Am. ed), p. 32.
[4] Works, ii. 122.
[5] Œuvres de TISSOT, i. 462.
[6] Practical Illustrations, etc., sup. cit.
[7] N. Amer. Med. and Surg. Journ., iii. 34.

tions. More recently it appears to have been much prized for the same purpose by Bellinghiere and Bertini, of Turin.[1] To these evidences we are enabled to add a personal experience of its value, which we believe to be equalled by that of no other medicine in chronic bronchitis unattended with fever. In cases attended with hectic, copaiba, although far from always aggravating the symptoms, is still less generally beneficial, until the fever has been reduced somewhat by other means.

In protracted and obstinate *dysenteries*, copaiba was proposed by Armstrong as a means of healing the intestinal ulcers.[2] He remarks that it was formerly used for this purpose, and that we have been perhaps too hasty in discarding it. Dr. La Roche has likewise recommended it in the declining stage of acute dysentery when the stools are mucous rather than bloody.[3] Dr. Hatheway, of Illinois, speaks of it as a specific in dysentery, and is disposed to regard it as such in all stages of the disease.[4] Mr. Robarts has reported it to be very effectual in *chronic gastro-enteritis*, when given in doses of from seven to ten minims three times a day, made into an emulsion.[5]

Copaiba has been used with oil of amber and oil of turpentine to cure *nocturnal pollutions* depending upon debility of the sexual organs; also in chronic *irritability of the bladder* depending upon anterior gonorrhœa and excessive venery. Labat (1740) recommended it as having proved an efficient remedy for *intermittent fever* during an epidemic of this disease at Nantes. M. Hardy found the internal use of large doses of copaiba advantageous in some cases of *psoriasis*.[6] Mr. Simms noticed that the medicine is more efficient in young than in adult persons, and that the usual sign of its beneficial influence is the production of its specific eruption upon the skin. When it disagrees with the stomach, or purges, it does not, he says, benefit the psoriasis.[7] These results have been confirmed by Dr. Pindon.[8]

It has already been stated that copaiba "augments somewhat" the quantity of the urinary secretion; it appears, however, that in certain cases of *dropsy*, and especially of *ascites*, its diuretic operation may be very decided. This effect was first noticed, we believe, by Dr. Garrod in 1869. Since then several cases have been published, which appear to demonstrate the efficacy of the medicine in those affections, by Drs. Duffin,[9] Thompson, Greenhow,[10] Sieveking,[11] and another physician.[12] In all of these cases but one the dropsy was of hepatic origin, and in the remaining case it began in the face and was attended with albuminous urine. In all of them various other remedies, and in some even paracentesis, had been used without

[1] Am. Journ. of Med. Sci., xlv. 192.
[2] Op. cit., p. 556.
[3] Am. Journ. of Med. Sci., xxiii. 258.
[4] New York Journ. of Med., Dec. 1853, p. 56.
[5] Lancet, ii. 1839–40, 1. 569.
[6] Bull. de Thérap., iii. 268.
[7] Practitioner, v. 48.
[8] Dublin Quart. Journ., May, 1871, p. 393.
[9] Lancet, Feb. 1869, p. 292.
[10] Trans. Clinical Soc., iii. 26, 30.
[11] Lancet, Dec. 1870, p. 853.
[12] Bull. de Thérap., lxxix. 331.

avail, when the copaiba was prescribed and appeared to produce a permanent cure. The dose of the medicine varied from five to thirty drops three times a day, and in all cases gave rise almost immediately to an increased secretion of urine.

As a *local* application, copaiba was formerly used as a dressing for wounds and sores, whence its popular name of *balsam*. In recent times Sachs recommended it strongly as an application to the *sore nipples* of nursing women. He assures us that if used before there is an absolute loss of substance, but only increased tenderness and commencing abrasion or fissure, it will arrest the evil. He directs it to be applied upon fine linen compresses, which, if they adhere, can be removed by moistening them with the balsam; and also that the nipples should be washed with warm milk before the child is allowed to nurse.[1] Dr. Ruschenberger advises it as an application to *chilblains*, for which, like other terebinthinate stimulants, it is an excellent remedy.

Administration.—Copaiba may be given pure floated upon the surface of the water, on which a few drops of tincture of gentian are then poured; or inclosed in gelatinous capsules; or solidified by magnesia; or in emulsion prepared with mucilage, or yelk of egg and some aromatic water, to which a few drops of laudanum may be added if the bowels are relaxed. Equal quantities of copaiba and solution of potassa make a perfect solution, which can be diluted and flavored according to the requirements of the case. This is an eligible method, when small doses only are to be given. The dose will vary, according to circumstances, from *ten drops* to nearly *half an ounce* in twenty-four hours; but the latter quantity should be reached very gradually, and given only where the medicine is thoroughly tolerated.

The *oil* of copaiba may be given in doses of from *twenty drops* to *one* or *two fluidrachms*. It may be taken on a lump of sugar or in emulsion.

CUBEBA.—CUBEB.

Description.—Cubeb is the unripe fruit of *Cubeba officinalis*, or *Piper cubeba*, a climbing perennial plant which grows wild in Java and the Indian Archipelago. It is about the size of a small pea, of a blackish-brown color, rough, and furnished with a small footstalk. The shell is woody, and contains a hard, round seed, which is white within and oleaginous. It has an aromatic odor and a warm, peppery, and camphoraceous taste, and contains about ten per cent. of an essential oil, less than one per cent. of cubeb camphor, four per cent. of cubebin, and about three and a half per cent. of cubebic acid, besides other less important constituents, etc. The oil is transparent and colorless; it has a specific gravity of 0.929, the characteristic odor of the berries, and a hot, aromatic taste.

[1] Handworterbuch, etc., I. Abth., II. Theil, S. 303.

Cubebin, when pure, is without smell or taste, and is soluble in alcohol and oils. It is closely analogous to, if not identical with, piperin. Cubebic acid is snow-white, of a silky lustre, brittle when cold, but softening and melting with a moderate heat. It adheres to the teeth when bitten, and has a faint waxy taste; is also soluble in alkaline liquids, in alcohol, ether, and chloroform.

The officinal preparations of cubeb are the following:—

Extractum Cubebæ Fluidum.—*Fluid Extract of Cubeb.*

It is prepared officinally like other fluid extracts. Dose, from ten to thirty drops.

Oleoresina Cubebæ.—*Oleoresin of Cubeb.*

It is obtained by treating powdered cubeb with ether in a percolator, and distilling and evaporating the ether used in the process. Dose, from five to thirty drops.

Oleum Cubebæ.—*Oil of Cubeb.*

This oil is obtained from ground or powdered cubeb by distilling with water. Dose, from ten to fifteen drops.

Tinctura Cubebæ.—*Tincture of Cubeb.*

It is prepared by percolation with four troyounces of bruised cubeb and diluted alcohol, to the production of two pints of tincture. It is seldom used, but its dose is stated at half a fluidrachm as a carminative, and at two or three fluidrachms in gleet.

History.—The Greeks and Romans do not appear to have been acquainted with this medicine. Pereira, it is true, is inclined to the opposite opinion, because the ancients made use of the word μιρτίδανον, which the modern Greeks apply to cubeb. But it is more probable that they used the word generically, much as the word *piper*, and even *pepper*, is now employed; thus, we say piper longum, piper caudatum, red pepper, black pepper, etc. Several Arabian writers describe it as possessing diuretic virtues, and as fitted to cleanse the kidneys and bladder of sand and gravel.[1] Matthiolus[2] discusses the question of the identity of this medicine with the *capsicum* of Galen, and concludes it to be different. He describes its virtues as being chiefly stimulant. For these qualities it was used in Europe during the middle ages, and afterwards in the treatment of leucorrhœa, sterility, and impotence.[3] Acosta, who has a very interesting account of cubeb, says that the Oriental physicians use it to comfort the stomach, to resolve the enlarged and oppressed spleen, to expel flatulence, and to stimulate the womb; but that the principal object for which they employ it, and that in large quantities, is to promote the venereal appetite.[4] Alston, and the authorities he quotes, give no other account of the medicine than this.[5] In the East Indies it has long been employed as a popular

[1] Ebn Baithar, Heil- und Nahrungsmittel, i. 354.
[2] Commentaries, liv. i. chap. x.
[3] Strumpf, Handbuch, i. 696.
[4] Delle Droghe Medicinali, etc., 1585.
[5] Materia Medica, ii. 281.

cure for gonorrhœa.[1] From thence it was introduced into Europe, in 1818, by two English surgeons, Mr. Adams and Mr. Crawford.[2] Pereira states, however, that cubeb was in use in England more than five hundred years ago, for in 1305 Edward I. granted to the corporation of London the power of levying a toll of one farthing a pound on this article in its passage over London bridge. But it was employed only as a condiment.

Action.—The action of oil of cubeb upon *rabbits* has been studied by Godecke.[3] He found that in the dose of an ounce it acts poisonously upon these animals, and produces symptoms like those of the essential oils generally, and especially like that of copaiba, but more strongly characterized. It penetrates the urinary organs and the peritoneum, provokes diuresis, quickens the pulse, excites diarrhœa, produces vascular injection of the gastric mucous membrane and of the kidneys, and renders the urine albuminous. The last statement may have been founded on the cloudiness produced by the precipitation of the oleoresin on the addition of an acid to the urine. Crawford, in his original description of cubeb, referred to above, says that it occasions, but not always, a slight purging (in which, we may remark, that a sense of warmth is felt about the rectum), imparts to the urine its peculiar odor, and augments its quantity. Now and then it causes flushing of the face and a burning heat in the palms of the hands and soles of the feet. Its continued use does not appear, like that of copaiba, to derange the digestive function and destroy the appetite. On the contrary, it tends rather to strengthen them; and hence it may be advantageously substituted for copaiba when that medicine is not tolerated. An attack of partial paralysis of the face following the use of cubeb has been attributed to this medicine.[4] Crane noticed that it sometimes appeared to increase the venereal excitement and cause a sense of heat about the rectum and perineum.[5] More recently, Clarus assures us that when given in the inflammatory stage of gonorrhœa it may occasion violent inflammation of the neck of the bladder.[6] Crane further remarked that it occasionally produced mental irritation and anxiety, and, if the dose was too large, nausea and vomiting. These effects resemble those observed by Pul in experiments upon himself. He found that doses of a drachm only caused some thirst and heat in the throat, two drachms slight feverishness, and three drachms nausea, eructation, heat at the epigastrium, headache, malaise, and an ephemeral fever.[7] A singular view of the medicine's operation is taken by M. Dieu,[8] who alleges that its action is sedative, and is curative because it is sedative. In support of this notion he cites several cases of gonorrhœa cured by cubebs, in which, during the progress of the cure, the pulse fell from 70 to between 40 and 50. But he neglects altogether the influence of

[1] AINSLIE Mat. Indica, i. 98.
[2] Edinb. Med. and Surg. Journ., xiv. 32, xv. 61.
[3] CLARUS, op. cit., p. 727.
[4] Lond. Med. Gaz., i. 405.
[5] Edinb. Med. and Surg. Journ., xxi. 302.
[6] Speciell. Arzneim., p. 728.
[7] MITSCHELICH, Lehrbuch., ii. 240.
[8] Mat. Méd., iii. 935.

rest, low diet, and the subsidence of pain and inflammation, which suggest themselves as the more probable causes of the alleged phenomena. Cubebic acid appears to have very decidedly diuretic qualities. According to Beidenreich, this acid (or resin), when taken in doses of from seven to ninety grains, produces a lively sensation of heat in the stomach, increases the urine and renders it irritating.[1]

An eruption resembling urticaria is sometimes produced by this medicine, as it is by copabia. Several cases of this sort—and the first, it is believed, on record—were reported by Mr. Crane in 1832.[2] A case was observed by Dr. Cazentre, of Valparaiso, of death attributed to cubeb.[3] The symptoms were congestion of the face, dilated pupils, insensibility, a slow, feeble, and irregular pulse, and rattling respiration, and the lesions consisted of vascular engorgement of all the great viscera, and of the right side of the heart. Such effects naturally suggested a doubt as to the character of the powder taken; and subsequently, on being analyzed by Mr. Procter, of Philadelphia, it was found to contain thirty per cent. of opium.

Uses. *Gonorrhœa.*—The earlier observations in regard to the use of cubeb in this disease have been confirmed by subsequent experience. Crawford (1821) found that it cured the great majority of cases within three weeks, and was most successful in the mildest and most recent cases.[4] This was also the result of Mr. Jeffrey's practice. He exhibited cubeb in all the stages and under all the circumstances of the complaint, without any bad results.[5] Delpech confirmed these statements,[6] and also Velpeau, who administered the medicine by the rectum.[7] Sir Astley Cooper, who was one of the first to employ cubeb in the acute as well as in the chronic forms of the disease, spoke highly of its effects, and remarked that when the inflammation is just beginning, the medicine often succeeds in removing it in a very short time.[8] Ricord regards cubeb as hardly inferior to copaiba in the treatment of gonorrhœa. But he prescribes it in doses which would scarcely be tolerated for many days. Thus, he directs from *four* to *fifteen* drachms to be taken in the twenty-four hours.[9] Pereira is equally an advocate of a liberal use of the medicine, and directs as large doses as the stomach will bear, to be given in the early stages of the disease, considering it to be fully proved that it is more efficient then than at a later period. He does not even look upon active inflammation of the urethra as contraindicating its use, although he admits that it may occasionally aggravate the symptoms, as we have shown it may do by a reference to Clarus. But cases of the sort are not numerous enough to warrant our withholding such doses of the medicine as alone are curative. The remarks of Trousseau and

[1] Practitioner, iii. 321.
[2] Lond. Med and Phys. Journ. (N. S.), xii. 195.
[3] Am. Journ. of Med. Sci., April, 1833, p. 304.
[4] Med.-Chir. Trans., xii. 99.
[5] Med.-Chir. Review, ii. 271.
[6] Archives Gén., iii. 601.
[7] Ibid., xiii. 47, 53.
[8] Lancet, May, 1824, p. 201.
[9] BUMSTEAD's edit. of Hunter, p. 118.

Pidoux upon this subject are just. They say the intensity of the inflammation, the painful swelling of the penis, the abundance and virulence of the discharge, and the fever which sometimes attends, are less formidale in reality than in appearance, and often accompany a discharge which is more easily curable than some which are very obstinate in spite of their apparent mildness. It is not, however, easy to determine how far, if at all, antiphlogistic measures should precede the use of cubeb. Undoubtedly they must sometimes be resorted to, not merely on account of the symptoms just referred to, but also on account of an undue and excessive development of those symptoms.[1] On the whole, it would appear that the inflammatory element, so far from being a contraindication to the use of the remedy, is in reality a motive for its employment. As in the case of copaiba, it acts by substitution, and destroys the morbid inflammation by its therapeutical inflammation or stimulation. This is what Crane suggested long ago (1824), when he considered that the efficacy of cubeb might arise from "a counter-irritation incompatible with the inflammatory excitement arising from the disease."

The laborious investigations of Bernatzik[2] have shown that neither the oil nor the resin of cubeb, nor cubebin, possesses any curative virtues in gonorrhœa, but that these depend entirely upon cubebic acid. It was administered by him in pills each containing a grain and a half. From five to twenty pills were taken daily, and generally the dose was rapidly increased, and its administration continued for at least a week. Several acute cases were rapidly cured; but the treatment had no effect upon a gleet.

Of *leucorrhœa* several cases were reported by Dr. Orr, cured in a short time by cubeb, in the dose of a drachm and a half three times a day.[3] Dr. Traill, also,[4] and Dr. Crane,[5] gave it with equal advantage. Velpeau reports the cure of several in which *enemata* of cubeb were thrown into the bowels.[6]

Trousseau has called attention to the usefulness of cubed in *irritability of the urethra* in females.[7] This annoying ailment, which is sometimes met with in young girls, but more frequently in married women, is attended with an almost constant desire to urinate, severe smarting as the water is evacuated, and afterwards tenesmus of the bladder. At the same time there are pains in the loins and a sense of weight in the pelvis. A slight discharge of mucus, which is sometimes bloody, may precede or follow urination. For this distressing affection cubeb is the most successful remedy, administered twice a day at meal times in doses of from thirty to sixty grains, and continued in diminishing quantities for several days after the cessation of the symptoms. A somewhat analogous affection is occasionally observed as a consequence of blistering with cantharides, even where strangury has not occurred as the imme-

[1] Thérapeutique, ii. 459, etc.
[2] Prager Vierteljahrs., lxxxi. 9; lxxxv. 81.
[3] Edinb. Med. and Surg. Journ., xviii. 318.
[4] Ibid., xvii. 312.
[5] Ibid., xxi. 304.
[6] Archives Gén., xiii. 54.
[7] Bull. de Thérap., lxi. 18.

diate effect of the treatment; it is also removable by cubeb. Nocturnal *incontinence of urine*, which is generally perpetuated by irritability of the neck of the bladder, has been cured by the same medicine.

Debout has particularly called attention[1] to the efficacy of cubeb in certain *nervous disorders*. It was formerly supposed to be a remedy for "nervous headache, vertigo, apoplexy, paralysis, and loss of memory." Richter mentions that hysterical women made use of a confection of cubeb to cure the vapors, fainting, etc.[2] The particular condition which appears to have been beneficially modified by this medicine consists of occasional vertigo with nervous debility and partial loss of muscular power simulating the commencement of paralysis from central disorder of the brain, such as is frequently occasioned by excessive mental emotion or intellectual labor, and is associated with dyspeptic derangements. He advises its administration in doses of from eight to thirty grains twice a day when the digestion only is deranged; but that the quantity suited to combat the vertiginous affection should be at least one hundred and fifty grains a day, in two or three doses, taken at meal times.

In *chronic cystitis* Brodie recommended small doses—fifteen or twenty grains—to be given three times a day. He found that they palliated the symptoms.[3]

Cubeb may also be employed in chronic and atonic *pulmonary catarrh*. Indeed, owing to its stimulant action upon the stomach, it may become more serviceable than copaiba in cases of the disease attended with feeble digestion.

In *chronic rheumatism* it has also been found occasionally beneficial.

Administration.—Cubeb is generally administered in *powder*, in the dose of from *ten grains* to *half an ounce* or *more* three times a day. In gonorrhœa the average dose may be stated at *one hundred and twenty grains.* It should be gradually diminished after the running has ceased. Of the *fluid extract* the dose is from ten to thirty drops. The *oil* may be given in doses of from *ten* to *fifteen drops*, gradually increased to a *fluidrachm.* It may be administered upon sugar, in emulsion, or inclosed in gelatin capsules.

The dose of the *oleoresin* is about the same as that of the oil. It should be inclosed in capsules. The dose of the *acid*, which is conveniently administered in the pilular form, is from *one* to *two grains.* Bernatzik proposed to diminish the bulk and palliate the taste of the dose of cubeb necessary in the treatment of gonorrhœa, etc., by using the powder from which the oil has been extracted by distillation; but even of this preparation not less than 750 or 1000 grains daily would be required.

A *tincture* is also officinal, which may be given in doses of *half* a

[1] Bull. de Thérap., lxi. 56.
[2] Ausfürl. Arzn., iii. 130.
[3] Lond. Med. Gaz., i. 300.

fluidrachm to *two fluidrachms.* It is of use chiefly in gleets, and as a stimulant carminative.

COLCHICI RADIX.—Colchicum Root.

COLCHICI SEMEN.—Colchicum Seed.

Description.—*Colchicum autumnale* is a biennial plant of the Natural Order *Melanthaceæ*, and is also known by the name of *autumn crocus* and *meadow saffron.* It is a native of the temperate parts of Europe, and is somewhat cultivated in this country. It may be propagated from the seeds, by a single mature *cormus*, or, as Dr. Christison has shown, by several immature cormi. The corm, or solid bulb, is about the size of a small apricot when mature, which is in the month of June, is of firm texture, amylaceous, and extremely bitter. Soon after reaching maturity it gives off at its lower part a small bulb, which, by the month of September, has shot up into a flower stalk some six or eight inches high, and bears a lilac or purple flower. After several weeks this offshoot dies down, and nothing more is seen above the ground until the following February, when the leaf-stalk appears, terminating in three or four leaves, which shelter the capsules. These reach maturity in the course of the following summer, at which time the cormus has acquired its full medicinal power.[1] It has an external brown coat, and an inner one of a reddish-yellow color. A transverse section of it is somewhat kidney shaped, and its substance is white and fleshy. When fresh, a milky juice exudes from it, and it exhales a rank smell. Its taste, like that of the seeds, is somewhat acrid and bitter. The seeds are rough, almost spherical, of a dark-brown color, and about the size of millet seeds. They have an extremely bitter and acrid taste. The active principle of colchicum is called *colchicia.* It is not crystallizable, has a bitter but not acrid taste, and is soluble in water and alcohol but less so in ether. The preparations of the seeds are thought to be of more uniform strength than those of the corm, and therefore in general to be preferred. They contain a larger proportion of colchicia. A neutral crystalline principle, differing from this, has been announced to exist in colchicum by Oberlin termed *colchiceine*, and procured by him by the addition of muriatic acid to an aqueous solution of the active principles of the cormus. It is intensely bitter, neutral, insoluble in water and soluble in alcohol and ether. Subsequent researches by Mr. Carter and by Prof. Maisch, of Philadelphia, seem to demonstrate that colchicia is the true active principle of colchicum, and that colchiceine is a substance isomeric with the former. These points are, however, of pharmaceutical rather than of therapeutical interest, since, so far as they are known, both substances have the same operation.

[1] Maclagan, Month. Journ. of Med. Sci., Dec. 1851, p. 501.

The following are officinal preparations of colchicum:—

EXTRACTUM COLCHICI ACETICUM.—*Acetic Extract of Colchicum.*

This extract is best prepared by percolation. Twelve troyounces of powdered colchicum root are exhausted by means of four fluidounces of acetic acid diluted with water, and the resulting liquid is evaporated to a proper consistence. Dose, one or two grains, and gradually increased.

EXTRACTUM COLCHICI RADICIS FLUIDUM.—*Fluid Extract of Colchicum Root.*

From sixteen troyounces of powdered colchicum root twelve fluidounces of tincture are procured with alcohol, glycerin, and water; this product is set aside until two pints more of tincture are obtained, which are then mixed with the reserved tincture, and the whole is evaporated to four fluidounces. Dose, ten minims.

EXTRACTUM COLCHICI SEMINIS FLUIDUM.—*Fluid Extract of Colchicum Seed.*

It is produced by the same process as the fluid extract of the root. Dose, ten minims.

TINCTURA COLCHICI.—*Tincture of Colchicum.*

This tincture is prepared with four troyounces of bruised colchicum seed and enough diluted alcohol to produce two pints by percolation. Dose, from half a fluidrachm to two fluidrachms.

VINUM COLCHICI RADICIS.—*Wine of Colchicum Root.*

Twelve troyounces of powdered colchicum root are treated with a sufficient quantity of sherry wine, and two pints of filtered liquid are obtained by percolation. Dose, from ten minims to a fluidrachm, repeated several times a day.

VINUM COLCHICI SEMINIS.—*Wine of Colchicum Seed.*

This wine is prepared by macerating four troyounces of powdered colchicum seed in two pints of sherry wine for seven days, expressing the residuum, and filtering the liquor. Dose, half a fluidrachm to a fluidrachm three or four times a day.

History.—Dioscorides describes this plant under the names of colchicum, ephemerum, and wild bulb, and states that it abounds in Messenium and in the isle of Colchos. Its poisonous effects, he says, resemble those produced by mushrooms, and he proposes milk as the best antidote for them.[1] Galen alludes to its poisonous qualities. Paul of Ægina, who flourished in the next century, speaks of hermodactylus (which Mr. Adams, in common with Bergius, Tournefort, Geoffroy, Pr. Alpinus, and Paris, regards as identical with colchicum), and of its use in gouty complaints, remarking at the same time, what some modern writers have insisted upon, that it is injurious to the stomach, producing nausea and anorexia, and ought to be used only in the case of those who are pressed by urgent business; for it removes rheumatism [gout?] speedily, and

[1] Mat. Med., iv. 79.

after two days at most, so that they are enabled to resume their accustomed employment.[1] Alexander of Tralles, who wrote in the fifth century, refers, in his treatise upon gout, to hermodactylus as a medicine which produces watery stools, followed by such relief that the patient is presently able to walk. Yet he adds, like his predecessors, that it increases the liability to attacks of the disease. Of the Arabian physicians, Elgâfaki describes the plant and the peculiarities of its growth and flowering. Hobaish, Mosih, and Avicenna refer to its power of alleviating rheumatic and gouty pains, and to the advantages of associating with cathartic medicines. The last-named author recommends poultices of the root in painful affections of the joints. Others attribute to it aphrodisiac virtues.[2]

Like so many other valuable remedies, colchicum appears to have fallen into disuse, until, in 1718, it was proclaimed by Wedel to be a prophylactic against the plague; but in this respect it obtained no permanent credit. Once more, in 1763, Störck brought it forward as a remedy for dropsy, gout, and chronic catarrh, but especially for the first-named disease, and his views found numerous supporters. But colchicum does not seem to have been generally accepted as an anti-arthritic remedy until the period between 1814 and 1820, when the publications of Want, Home, Haden, Williams, Copland, and others demonstrated its efficacy and established it in the confidence of physicians. Mr. Want especially,[3] was struck with the close resemblance which the symptoms produced by a celebrated gout nostrum, the *eau médicinale*, bore to those which the ancient writers ascribed to hermodactylus and colchicum, and also with the fact that colchicum entered into the composition of Turner's powder, the Vienna decoction, and other specifics for gout. He accordingly administered it with success, and showed, contrary to the opinion of Sutton and others, that its curative effects do not necessarily depend upon its cathartic properties. It is also asserted[4] that Mr. Want obtained his knowledge of the composition of the French nostrum through a servant who formerly lived in the proprietor's family, and who purloined a portion of one of the bulbs he made use of, which, on examination, proved to be colchicum. Mr. Haden[5] endeavored to prove that the remedy might be used as a substitute for bleeding, for which purpose he furnished imperfect histories of febrile attacks from which recovery took place while colchicum was being used; a statement which would have been equally true of many other medicines, and also of no medicines at all.

Action. *On Animals.*—In estimating the activity of colchicum, the variable strength of its preparations must be kept in view. This often depends upon the cormus having been gathered at a

[1] Paulus Ægineta, ed. Adams, i. 66.
[2] Ebn Baithar, ed. Sontheimer, ii. 65.
[3] Med. and Phys. Journ. (1814), xxxii. 77, 312, etc.
[4] Dub. Quar. Journ., xxx. 210.
[5] Practical Observations on the Colchicum Autumnale. 1820.

season when it is nearly inert. As before remarked, it is most active in July and August; the seeds are of more uniform strength, and the flowers and leaves are feebler. The plant is poisonous to most herbivorous animals, and is generally avoided by them when grazing. But it is sometimes eaten among their fodder, and then it may produce bloody flux, and death, with inflammation of the bowels.[1] Haden mentions its purging a horse violently. Given to dogs by Störck, it caused vomiting, trembling of the limbs, convulsive movements of the belly, howling, diuresis, bloody stools, prolapse of the rectum, and death. From the peculiar severity of the symptoms caused by colchicum in dogs, the French call it *mort au chien*. Braun describes as follows the effects produced in six cows that had eaten the colchicum plant. There was loss of appetite and thirst; chewing the cud was suspended; diarrhœa of a thin, whitish liquid took place; the anus gaped; there was a frequent and feeble pulse; running at the eyes and nose; dulness of the senses; distension of the belly, and scanty urine; the hair stood erect and rough; and there was tenderness on pressure over the maw. One of the cows and a calf died; the lining membrane of the intestine was found injected and red, and the blood dark and liquid.[2] The action of colchicum upon certain animals is very feeble. As much as six and a half drachms of the wine of the seeds was given by Lewins to a *rabbit* in the course of four days, with very little effect beyond acting upon the kidneys. On *frogs* its influence is equally slight. Some experiments upon them show a singular insusceptibility to the action of the medicine. It caused, indeed, a disposition to vomit, weakness, some convulsive movements, and tetanic rigidity; but the animals recovered from doses which are fatal to large dogs.

Forty drops of the wine of the seeds were given to a *cock*, without evident effect. On the next day eighty drops produced dulness and loss of appetite; one hundred and twenty drops causing vomiting of mucus, and copious watery dejections, with extreme debility and depression; the next day one hundred and eighty drops reproduced these symptoms, and destroyed the animal within twenty-four hours. Its intestine was filled with half-digested food, and showed spots of vascular injection. Lewins[3] gave seventy minims of the wine of the seeds to a middling sized *dog*. No distinct symptoms were observed within six hours, but at the end of sixteen hours it was found that the animal had vomited and been purged, and that the egesta contained blood. He lay prostrate and motionless, refused food, and his eyes were glazed and sunken; he died without any reaction. The intestines were found to be everywhere injected, the jejunum and ileum were intensely red, and the whole bowel was lined with bloody serum and thin mucus.

Sir Everard Home injected one hundred and sixty drops of a vinous infusion of colchicum into the *jugular vein* of a *dog*. The

[1] MURRAY, Apparat. Medic., v. 198. [2] FRANK, Mag. für Arzneim., iii. 143.
[3] Edin. Med. and Surg. Journ., lvi.

immediate effects were loss of muscular power, slow breathing and a feeble pulse; but reaction took place, and the pulse and respiration became frequent. The animal trembled violently for an hour and a half; made ineffectual efforts to vomit, and fell into a languid state; vomiting of bloody mucus and diarrhœa followed, the languor continued, and in five hours death took place. The whole mucous membrane of the intestine was "inflamed." The same experiment was performed by Scudamore, and with like results.[1] According to the experiments of Andral and Magendie, the preparations of colchicum, when injected into the veins, act upon the intestinal canal, and excite vomiting and purging.

Colchicia produces the same effects as the plant from which it is derived. One-tenth of a grain of this substance given to a kitten eight weeks old took away its appetite, brought on vomiting, purging, and debility, and death in twelve hours. The stomach and small intestines were "inflamed and congested." According to Albers, who performed his experiments upon toads, colchicia acts specifically upon the skin, destroying its sensibility, produces paralysis of the voluntary muscles, without previously exciting spasms, and does not affect the movements of the heart.[2]

The *colchiceine* of Oberlin was used by Dr. Percy in experiments upon dogs. In the dose of one or two grains it occasioned the gastro-intestinal symptoms already described, and in addition very frequent and ineffectual attempts to urinate. The animals died in from eight to eleven hours. Besides marks of intense inflammation of the mucous membrane in the stomach and intestines, the Malpighian bodies of the kidney were very red and highly congested. Black pitchy blood was found in the heart, the veins, and aorta, and even in the arteries of the legs and neck.[3]

The results of these experiments are simple; the poison evidently acts with greatest energy upon the nervous and the digestive systems; causing, through the one, depression, faintness, and trembling, and through the other a real cholera-morbus. Diuresis is most marked when the emeto-cathartic effects are slightest (as in rabbits); no narcotic effect is observed, and the material lesion found is intense hyperæmia of the intestinal canal, and, in dogs, of the kidneys also. These phenomena, it will be seen, are very nearly the same as those produced by colchicum in man.

On Man.—Störck relates that after swallowing one grain of the bulb of colchicum he experienced flushes of heat, colic, pain in the urinary passages on micturition, tenesmus, mucous stools, headache, hiccup, disturbed pulse, anorexia, thirst, and other marked symptoms which are so unlikely to have been produced by the trifling dose of colchicum mentioned, that the whole description has been taxed with being an invention. Still it is very certain that such precisely are the symptoms occasioned by large doses of

[1] MACLAGAN, loc. cit.
[2] Prager Vierteljahr., lx. Anal. p. 8.
[3] Am. Med. Times, iv. 187.

the drug, and occasionally by very small ones. The following description comprises the most usual and important of these effects.

The *nervous system* is seldom disturbed by medicinal doses of colchicum. In a large series of cases reported by Monneret,[1] although the digestive functions were much deranged, those of the nervous system were unimpaired. Kuhn, however, observed headache and vertigo among the effects of the medicine.[2] Some writers ascribe a narcotic virtue to this medicine, as confusion of the mind, giddiness, sopor, and delirium (*Schroff*); and others, besides these symptoms, describe buzzing in the ears, a yellowish haze before the eyes, formication in various parts of the body, dyspnœa, palpitation, etc. Probably most of these phenomena arise from the rapid exhaustion produced by colic, vomiting, and purging. Sir Everard Home seems to have been the first to notice the property of colchicum to diminish the frequency of the pulse (1816). Dr. A. T. Thomson also drew attention to this phenomenon, which is unquestionably one of the physiological effects of the medicine. In this country it was early noticed by Dr. J. Y. Clark.[3] It ceases as soon as the poisonous action begins. Dr. Maclagan took twenty minims of tincture of colchicum on two different days, between the hours of six and eight in the evening, and found that by midnight his pulse had fallen to about 65.

When applied to the *skin*, the fresh cormus is said to cause redness and prickling, with diminished sensibility. The powder, if inhaled, excites sneezing and coughing. Upon the *tongue* it produces an acrid, bitter, and astringent taste, with irritation of the fauces, and salivation. Sachs found that chewing the bulb occasioned irritation, pain, and tension, followed by insensibility and rigidity of the tongue. Dr. R. J. Buckner reports a case in which copious *ptyalism* was attributed to colchicum given in doses sufficient to produce vertigo and a burning heat in the fauces and stomach.[4] Dr. Aldridge refers to three cases in which profuse ptyalism resulted from the use for some time of half a drachm of tincture of the seeds three times a day.[5]

The action upon the *digestive* organs is more uniform and distinct. When small doses of colchicum have been used for several days in succession, or a pretty large dose has been taken at once, some heat is felt at the epigastrium, with eructations, and perhaps nausea. If continued, the appetite fails, the tongue becomes coated, there is some colic, with borborygmi and diarrhœa. Still larger doses excite vomiting and purging. Monneret,[6] who gave from one to four drachms of the tincture to rheumatic patients in the course of twenty-four hours, found that its most uniform effects were nausea, vomiting, borborygmi, colic, and diarrhœa. The vomited matters were usually bilious, the tormina and tenesmus were sometimes severe and incessant, with heat and smarting of the anus, and dys-

[1] Loc. inf. cit.
[2] Archives Gén., xvii. 393.
[3] Phila. Med. Recorder (1818), i. 369.
[4] N. Am. Med. and Surg. Journal, x. 205.
[5] Dub. Hosp. Gaz., Oct. 1845.
[6] Archives Gén., Mars, 1844.

enteric stools. That is to say, the dejections, after being colored with bile, became serous, and contained white specks, yellowish and bloody mucus, a solid reddish substance (fibrin?), and some blood. In fact, they had the chief characters of dysenteric stools. It was also found that effects of this sort were more common when the intervals between the doses were short. It is singular that, in spite of these severe symptoms and the nature of the discharges, which seemed to indicate intestinal inflammation, there was still no tenderness of the abdomen under pressure, and the evacuations ceased soon after the suspension of the medicine. It may be that colchicum tends rather to produce an exaggerated activity of the vascular and secretory elements of the bowel, than to operate as a direct and local irritant. In this connection, it should be borne in mind that the action upon the bowels is manifested even when the medicine is introduced by the veins.

The first notice of the influence of colchicum upon the *urine* was that of Chelius, in 1828,[1] who found that during its use the proportion of uric acid in this secretion was nearly doubled. Dr. Christison afterwards found a similar increase in the proportion of *urea* and of *urate of ammonia*, raising the specific gravity of the liquid to 1.034. These results might be attributed to the diseases which the patients under observation were affected with, were it not that they were also obtained by Dr. Maclagan when no such disturbing element existed. It must be confessed, however, that they are not uniform, since both Graves and Gairdner found the urates to diminish under the use of the medicine. Perhaps these opposite results may be reconciled by those of Böcker,[2] who concluded, from some experiments performed by himself, that colchicum acts but little on the amount of the urinary secretion, and that when its solid elements decline under the use of the medicine, it is because those of the intestinal evacuations are increased. This accords with the results of Krahmer and Bird,[3] but disagrees with those of Dr. Hammond's experiments upon a healthy person, in whom colchicum produced an increased elimination of water as well as of solid matter, both organic and inorganic.[4] Schroff found no increase either of the urine or of the elimination of uric acid. And it is very certain that in poisonous doses this medicine diminishes and may entirely suppress the secretion of urine, by its irritant action, probably, upon the kidneys. Thus Störck, having taken an excessive dose of colchicum, suffered greatly from strangury, accompanied with scanty and scalding urine. In cases, too, of poisoning by this substance, the secretion of urine is often diminished, partly, it is true, in consequence of copious alvine evacuations, as well as on account of renal congestion.

According to Kuhn, if a person is placed in a condition to favor it, *diaphoresis* will very generally be produced by colchicum so long

[1] Archives Gén., Mars, 1844, xviii. 111.
[2] Beiträge zur Heilkunde, ii. 216.
[3] BIRD, On Urinary Deposits, 2d Am. ed., p. 354.
[4] Am. Journ. of Med. Sci., Jan. 1859, p. 278.

as it does not act upon the bowels. Dr. Netta attributed to the medicine an action upon the *uterus* like that of ergot, but the single case on which he bases his opinion is quite insufficient to support it.[1] The same remark will apply to a case attributed to Dr. Clutterbuck.

Dr. Laycock observed that when tincture of colchicum is rubbed into the skin of the abdomen, the characteristic signs of its operation are produced, such as tenesmus, mucous stools, depressed pulse, etc.[2]

The following is a summary of the effects of *colchicia* on the healthy system, as recorded by Schroff.[3] Soon after the one-hundredth of a grain of this substance was taken it produced eructations, nausea, and salivation. Within two hours the pulse fell eleven pulsations. Eight hours afterwards, two one-hundredths of a grain were taken in a wafer. At the end of six hours the experimenter, being in bed and asleep, was awaked with a desire to go to stool, and on rising, vomited for two minutes, and had a soft and copious stool, with violent griping. These symptoms returned some hours afterwards, and the stools were mucous, and of a greenish-yellow color. They did not immediately recur, but there was complete anorexia for several days, during which the stools were thin, flocculent, and albuminous, and accompanied with griping, and tenderness of the abdomen, with thirst, fever, accelerated pulse, cerebral distress, agitation, and want of sleep. The urine was thick, and gave a copious white deposit.

In *poisonous doses*, colchicum gives rise to symptoms of a very violent description, which are apt to terminate in death. The following is a summary of results from an analysis of ten cases which are reported in sufficient detail for our present purpose.[4] The forms of the medicine were various, including the tincture, the seeds, the infusion of the bulb, and of the leaves. The quantity of the alcoholic

[1] Am. Journ. of Med. Sci., Oct. 1844, p. 463. [2] Lond. Med. Gaz., xxiv. 388.

[3] Compare Brit. and For. Med.-Chir. Rev., Jan. 1858, p. 249; and Prager Vierteljahrschrift, liii., Anal., p. 5.

[4] Compare HENDERSON, Lond. Med. Gaz., xxiv. 762; LEROY DES BARRES, Bull. de Thérap., xxxiv. 498; FERIDAY, Lond. Med. Gaz., x. 161; NEUBRANDT, MACLAGAN, Mém. cit.; DILLON, ibid.; SCHILLING, FRANK's Mag. für Arzneim., ii. 139; SANTLUS, ibid., ii. 393; OLLIVIER, ibid., iii. 138; ANDREA, ibid., i. 42; BLEIFUSS, STRUMPF's Handbuch, ii. 485.

Other cases may be alluded to which were not at hand when those above were analyzed. See an article by Casper, relative to four fatal cases of colchicum poisoning (*Vierteljahrschrift für gerichtliche und öffentliche Medicin*, vii. Bd. 1, Heft.), in which he demonstrates the mode of obtaining *colchicin* from the contents of the stomach in cases of poisoning by colchicum, and concludes that *less than half a grain* of this principle is sufficient to destroy life. M. Roux has published an account of the death of five persons in the infirmary of the prison of Toulon, who died from the effects of about *two ounces* of the wine of colchicum seeds administered to each of them by mistake. (*Union Méd.*, and *Prager Vierteljahrschrift*, xlviii., *Anal.*, p. 3.) A case in which one ounce of the wine of the seeds was taken in the course of twenty-four hours, without a fatal result, is reported by Dr. Kennard. (*Am. Journ. of Med. Sci.*, Jan. 1857, p. 69.) For later cases, *vid.* Am. Med. Times, v. 339; Med. Times and Gaz., Oct. 1860, p. 420; CASPER's Vierteljahrschrift, xvii. 1; HENKE's Zeitschrift, xxxiv. 202; Prager Vierteljahrs., lxxxiv., Anal., p. 18; Bull. de Thérap., lxx. 325.

preparation always exceeded an ounce, and was generally between one and two ounces. The patients were all adults except two, who were boys of four and six years old. *Pain* in the abdomen is described in about half the cases, but not as very severe in more than two; its character was usually griping. It was generally one of the first symptoms to appear, and occurred at various intervals from half an hour to an hour after the poison had been taken. Sometimes it was spasmodic, and accompanied with cramps of the abdominal muscles. The epigastrium is said to have been slightly tender upon pressure in one case, and in two is expressly stated to have been indolent; in the rest, this symptom is not mentioned, and must, therefore, be supposed to have been slight. *Vomiting* was a prominent symptom in every case; it occurred among the earliest symptoms, and was the most persistent of them all; the fluids thrown up consisted of bile and mucus, sometimes tinged with blood; in one case, a substance like coffee grounds was rejected. *Retching* alternated with actual vomiting. In only two cases is the *thirst* said to have been great. *Diarrhœa* occurred in every case; the stools were generally frequent, liquid, greenish, or black, and fetid, or containing shreds and flakes as of coagulated mucus; tenesmus occurred in one or two cases, and in one, at least, the discharges became involuntary. The other symptoms furnished by the digestive organs were subordinate and not uniform. Thirst was by no means urgent except in one case, in which there was burning of the mouth and difficulty of swallowing. In another case, the taste was normal, and the tongue blue and cold. The quantity of *urine* was generally unaffected. In only two cases diuresis is mentioned, and in two suppression of urine.

Among symptoms affecting the *nervous* system, "*numbness of the hands and feet*, with prickling as if they were asleep, painful flexure of the joints, pain in the shoulder and hip-joints, and in all the bones, with difficulty of moving the head and tongue," are mentioned in one case only, which is reported by Dr. Henderson, of Edinburgh. The most prominent symptoms in this division were *spasms* affecting the voluntary muscles of the legs and arms, the abdomen, the chest, and, in one case, of the neck, throat, and fingers also. Occasionally, towards the close, there was subsultus, or floccitation. In one case in which two ounces of the seeds had been taken, the large size of the dose appears to have produced general loss of muscular power. (*Feriday.*) In another case, that of a child four years old, and where also the dose was relatively excessive, there was no decided spasm, but only muscular pains, and the little patient lay with half shut eyes, breathing hurriedly, protruding the tongue with difficulty, and evidently dying from sheer exhaustion. Muscular pains accompanied the cramps and continued in the intervals between them in several instances. Once there was pain in the knee, and once in the spine. In a single case, that of a boy six years old (*Schilling*), there were exceptional phenomena depending probably upon some cerebral lesion from which the patient died at the end of forty-eight days; but no *post-*

mortem examination was made. The symptoms alluded to were chiefly these: trembling; extreme sensibility; pains in both fore-arms; dilated pupils; convulsions, opisthotonos, and rolling of the head; deafness; swelling of the elbow and knee-joint of the left side; hemiplegia of the right, and convulsions of the left side, etc. In all, or nearly all of the cases, the *mind was clear* throughout the illness; there was no tendency to sleep except from exhaustion, no illusions, nor any perversion of the senses. The usual mode of *death* was by exhaustion; but once it came in a convulsive attack.

The *surface of the body* was uniformly in a state resembling that of collapse, with pinched and sunken features, purplish lips and cheeks, pale and shrunken and moist integuments, often livid, particularly in dependent parts, dilated pupils, cloudiness of the cornea, and a *small, thready, feeble*, and *frequent pulse.* Death probably resulted from exhaustion of the heart.

After death, the *lesions* found in seven out of the eight cases which proved fatal, were very uniformly the same. The skin is generally described as purple, livid, violet or greenish upon the back and sides, and there would seem to have been a tendency to rapid decomposition of the body. The lungs and brain were gorged with dark, imperfectly coagulated, and pitchy blood, and so were the veins of the trunk. The gastro-intestinal mucous membrane is generally described as inflamed, but, on closer inquiry, it seems rather to have been intensely congested in the stomach and small intestine, and in some situations to have lost its normal consistence. In perhaps one-fourth of the cases, its color was normal. Not unfrequently, ecchymoses were found in the submucous cellular tissue, and in several cases the vascular congestion extended to the peritoneal coat. In one case only there was no congestion at all.

The *duration* of the fatal symptoms seems not to have exceeded forty-eight hours in any case where the result depended directly upon the poison. The shortest period which it required to prove fatal in the adult was twenty-four hours.

In man, as in the lower animals, we may learn from the preceding statements and analysis, that colchicum expends its force upon the digestive organs and upon the nervous system, while at the same time it probably favors the elimination of solid effete matters from the economy by the bowels, the kidneys, and to some extent also by the skin.

Uses. *In Gout.*—In this country colchicum was early used as a remedy for gout by Dr. Dorsey, who found the joints "were relieved by it as by the wand of a magician."[1] He believed that it promoted sleep, and observed that it purged away dark fetid matter. In England Dr. Barlow (1822) strongly advocated its use, but insisted upon premising depletion and purgation with calomel and antimony. He directed two drachms of the tincture of the seeds at night, and, if necessary, a repetition of the dose the next morning, so as to purge briskly. If this effect was not produced, a similar

[1] Am. Med. Recorder, i. 376.

dose was prescribed the following night, after which the medicine was continued in smaller quanties and given in a saline mixture. Thus employed, he found that it purged, allayed the pain, and lowered the pulse. But he regarded its sedative more than its cathartic operation.[1] Sir H. Halford also gave it in conjunction with saline laxatives when the bowels were not already open; but he does not appear to have considered its purgative operation essential to its curative effects, for he states that it often cures the disease without any manifest increase of the secretions, though it sometimes acts as a diuretic and sometimes as a diaphoretic. Nor does he subscribe to the notion that the medicine is of little value because its effects are temporary, for, as he remarks, none other does even as much; and he denies that it renders the disease more apt to return, as ancient authors declared and some modern ones maintain.[2] Dr. Holland also dissents from this opinion, maintaining that, on the contrary, it may with due care be made a preventive as well as a curative agent.[3] There is no doubt that the certainty with which colchicum relieves the gouty paroxysm has led to a neglect of other medicines, of such as should be used at the same time with it to act upon all the secretions, and especially upon those of the liver and bowels, and also of remedies which should be employed after the attack to confirm the strength and subdue the tendency of the digestive organs to mal-assimilation of the food.

In regard to the value of its sensible operation, purgative or other, in gout, the views of several eminent authorities may here be alluded to. Dr. Christison, for example, does not regard its cathartic operation as either important or desirable except as an indication that the limit of the proper dose has been reached, and as a security that it is really acting upon the system.[4] Dr. Gairdner adopts a similar view, remarking that "colchicum never more effectually relieves the patient than when it acts silently and peacefully, without producing any evacuation whatever, or in any way disturbing the patient's comfort and ease." Mr. Wells, also, insists that the remedy is most efficient when it produces the least sensible effects upon the functions.[5] Dr. Todd says that if employed in such doses as will produce only its chemical changes, it will, in strong constitutions, most favorably modify the gouty paroxysm, and certainly shorten its duration. If, on the other hand, it produce any of its irritant effects, it is likely to do more harm than good. He lays down the following rules for the employment of the remedy, which it is believed embody the soundest precepts upon the subject.

"1. The use of colchicum is most applicable to the sthenic form of gout which occurs in robust constitutions, and in the prime of life; but it is almost inadmissible in persons advanced in years,

[1] Cyclopædia of Pract. Medicine, ii. 371
[2] Essays and Orations, p. 101.
[3] Notes and Reflections (1st Am. ed.), p. 89.
[4] Dispensatory (Am. ed.), p. 403.
[5] Pract. Observ. on Gout and its Complications (1854), p. 223.

who have had several attacks, and in whom the malady would seem too deeply rooted to be influenced by the temporary administration of the remedy.

"2. Colchicum should never be given at the onset of a paroxysm, nor until the bowels have been duly acted upon by mild purgatives.

"3. The first doses of the medicine should be very small; they may be gradually increased.

"4. Colchicum should be always administered at first uncombined with any other medicine, until the practitioner has satisfied himself that it does not disagree with his patient.

"5. It should not be administered so as to excite nausea, vomiting, or purging. These effects should be regarded as indicative of the unfavorable operation of the medicine.

"6. Colchicum may be regarded as acting favorably, when, under its use, the urine is increased in quantity, a more abundant bile is discharged; when the fæces, though solid, are surrounded by mucus and the skin secretes freely.

"7. The effects should be carefully watched; as, like digitalis and other medicines, it is apt to accumulate in the system."[1]

It will thus be preceived that there is very general conviction of the inutility, if not danger, of allowing colchicum to produce its emeto-cathartic operation in the treatment of gout. We have met with but one notable exception to this statement, that of Dr. Wigan, of Brighton, who, it must be added, had reference more particularly to "rheumatic gout." In this affection he pronounced colchicum to be "the most easily managed, the most universally applicable, the safest, and the most certain specific" in the Pharmacopœia. He employed the powdered cormus in doses of eight grains every hour in some mild and agreeable fluid, until active vomiting, profuse purging, or abundant perspiration took place. These effects are postponed as long as possible by giving the patient an occasional sip of some aromatic and stimulant drink, and generally until six or seven doses have been taken. His condition then resembles sea-sickness, and, like it, is very distressing, but when it has been endured for a few hours, the inflammation of the joints subsides, and they resume their natural size with miraculous rapidity. A sound sleep ensues, "from which the patient awakes perfectly well." Dr. W. affirmed that he had never seen a relapse.[2] It is possible that the administration of the medicine in divided doses may prevent serious consequences otherwise to be apprehended from such heroic treatment.

In regard to the *modus operandi* of colchicum in curing gout, there is no very wide division of sentiment. Some few refer its action to a vital influence, in great part at least. Thus Casimir Smith, of Warsaw, compares, as Vogt had previously done, its action with that of squill, because they are both sedatives of the circulation; but the former acts upon the bowels and the latter upon

[1] Brit. and For. Med. Rev., xvi. 467. [2] Lond. Med. Gaz., xxii. 576.

the kidneys.[1] Dr. Todd also refers its effects, in part, to its operation on the nervous system. But almost all writers of repute adopt the view originally proposed by Chelius, that it acts as an *eliminant*, or as a purifier of the blood, to use a more homely but more intelligible phrase. Chelius found that it increased the proportion of uric acid in the urine. It is possible that, as Graves pointed out, this was a mere coincidence, since the disappearance of the uric acid deposit from the urine, and not its supervention, is a favorable sign in rheumatism.[2] Kuhn, like Chelius, dwelt upon the value of the remedy in removing uric acid from the system in gout, and thus contributing to prevent the concretions which are so apt to form upon gouty joints. Dr. Lewins (1841) maintained that it promoted the evacuation of *urea* as well as of uric acid.[3] Dr. Holland[4] remarks there is every reason to believe that colchicum neutralizes or eliminates a gouty materies morbi (he does not attempt to pronounce upon its nature) from the system, for whenever the gouty inflammation manifests itself in the foot, in the bronchi, the eyes, or the head, producing a peculiar form of headache, the specific virtues of the remedy are equally apparent. Moreover, the early suspension of the medicine is apt to be followed by a renewal of the symptoms, as if its depurative action had not been completed. The attempts made to explain this operation have not been remarkably successful. Thus, Mr. Headland, after proving that colchicum acts upon the blood, remarks: "This hæmatic action must be of a catalytic kind, and may probably consist in the exertion of a special influence over the erring assimilative processes, which tends to resolve them into a right direction."[5] It can hardly be said that these phrases do much to lessen the obscurity of the question.

It has also been maintained that the augmented secretion of solids through the kidneys depends less upon the direct action of colchicum, than upon the sedative power which it exerts over the circulation, and which permits the discharge of matters, which in a state of greater vascular tension are retained. The following observations of Clarus upon this subject appear to deserve attention.[6] The view just presented explains why colchicum is a more certain remedy for gout than for rheumatism. In the former disease a large quantity of effete azotized matter is accumulated in the blood, the excretion of which must necessarily contribute to abate the fever and distress. In the latter there is no evident retention of a material poison in the blood; on the contrary, the cutaneous secretion is abundant, and the scanty urine results from the fever. In gout we may regard colchicum as a depletory and excretory agent, but in acute rheumatism as an antiphlogistic, and as tending to limit the formation of uric acid.

Rheumatism.—The views of some among the more prominent

[1] Abeille Méd., vii. 17.
[2] Lond. Med. Gaz., vii. 584.
[3] Edinb. Med. and Surg. Journ., and BRAITHWAITE's Retros., No. iv. p. 10.
[4] Notes and Reflections (Am. ed.), p. 89.
[5] On the Action of Medicines in the System, p. 319.
[6] Handbuch der speziellen Arzneim., p. 579.

advocates of colchicum in this disease may serve to show the nature and extent of its power. After Haden's publication in 1820 the medicine began to be tried as a remedy for rheumatism. Locher-Balber reported that it cured the acute disease surely and rapidly whenever it purged, but that it deranged the digestive organs temporarily.[1] About the same time were published the observations of Bart, Williams, Bang, of Copenhagen, Kirchow, Bushell, and Godart.[2] The last-named writer pointed out the sedative action which the medicine unites with its purgative operation, or exerts independently of the latter. He particularly described a prickling sensation with warmth which was felt by the patients in the affected limb, and which seemed to promote its power of motion. Afterwards Kuhn published several cases in proof of its efficacy, and in 1830 a complete history, natural and medical, of the drug, in which he alludes to the diminished pain and stiffness produced by colchicum, and attributes them to a temporarily blunted sensibility rather than to an improved condition of the part, for the pains, he says, return if the medicine is suspended.[3] Armstrong soon afterwards pronounced a more favorable judgment. In acute rheumatism, he says, "it certainly has given more speedy and decided relief than any other single remedy which I ever saw employed." In doing so, he adds, it did not act through the kidneys or skin, and but occasionally on the bowels, but it lessened the heart's action, the animal heat, and the pain.[4] Dr. A. T. Thomson expressed a similar opinion, but he only prescribed the medicine after calomel, tartar emetic, and opium.[5] Seymour gave an equally favorable verdict, but similarly qualified.[6] Chailly held it to be successful, but only when it produced a cathartic operation.[7] This also is the opinion of Dr. Watson, who ascribes to the remedy "an almost magical effect in quelling the *synovial form* of the disease," particularly when it produces its severer effects of vomiting and diarrhœa. Dr. Maclagan, on the other hand, thinks that the erratic articular form, that in which the internal organs are most apt to be affected, is the one in which colchicum is pre-eminently useful. Dr. Fuller, again, agrees with Dr. Watson that the synovial form is more amenable to the remedy than the fibrous, and that its benefits are dependent upon its evacuant, and especially its diuretic, effect.[8] These opinions should be compared with the statements of Dr. Wigan, above quoted, relative to rheumatic gout. The only attempt at a systematic and rigorous examination of the use of colchicum in rheumatism which we possess is that of Monneret,[9] who, however, from a defective method of classification, necessarily arrived at very discouraging results in twenty-one cases of the articular form of the disease. In eight cases only did the cure seem

[1] Revue Méd., xix. 132, 1825. [2] Archives Gén., xii. 602, 1826.
[3] Ibid., xvii. 393; Revue Méd., xxxix. 5, 191.
[4] Practical Illustrations (Am. ed.), p. 237.
[5] Lancet, 1834–5, ii. 73. [6] Med.-Chir. Rev., xxxiii. 659, 1838.
[7] Rev. Med., i. 207, 1836. [8] On Rheumatism, etc. (Am. ed.), 1854, p. 89.
[9] Archives Gén., 4ème sér., iv. 269.

to depend upon the remedy, and these were either very slight or quite chronic cases. Their improvement was evidently proportioned to the activity of the purgation which the medicine produced. In no instance was there any ground for referring to it a specific action. It is to be regretted that in this analysis the acute and chronic cases had not been distinctly separated, and the synovial from the fibrous variety of the disease. Previous writers had only claimed efficacy for colchicum in the acute synovial forms. Hence we feel no surprise when Dr. Cargill[1] reports but fourteen cures out of forty-three cases of *chronic* rheumatism. Dr. Eisenmann[2] contends for the curative powers of colchicum in all febrile and inflammatory affections produced by cold, which, according to him, constitutes them members of the group of rheumatic diseases. He recommends a mixture of six parts of wine of the seeds of colchicum with two of tincture of opium, in the dose of fifteen to twenty drops two or three times a day. The combination is a rational one, and deserves a more extended trial.

Various Diseases.—Several writers, among whom may be mentioned Lewins and Haden, speak highly of the efficacy of colchicum in "*fever*," but of what form, under what circumstances, and with what degree of success, does not appear. Mr. Tait conceived that he was very successful in treating *scarlatina* of an inflammatory type with colchicum.[3] Subsequently, Mr. Bennett, in a case of this disease, marked by alternate delirium and coma, and scanty urine without any deposit, gave colchicum together with acetate of potash and spirit of nitric ether. The cerebral symptoms disappeared, and a large quantity of urine rendered turbid by urate of ammonia was voided.[4] The share of the colchicum in this result is open to question.

Colchicum was originally proposed by Störck as a remedy in *dropsy*, and he claims to have used it very successfully. Others have since been equally fortunate. Among them Mason Good was a very emphatic eulogist of the remedy, for he ranked it next to squill in power. Clark, of Philadelphia, Locher-Balber, and Aran,[5] have reported cases of its success. In *scarlatinous dropsy*, Dr. Maclagan frequently found it of much service, particularly when the urine became very scanty, and indications were given of approaching coma. He thinks that urea retained in the blood is the cause of the symptoms, and that colchicum causes its discharge. The same writer proposes colchicum in the advanced stages of *Bright's disease*, as a means of depurating the blood.

In 1834, Mr. Cotter proposed colchicum as a remedy for *malignant cholera*, and states that he used it successfully in eight cases.[6] In spite of its homœopathic adaptation to this disease, it does not seem to have been used again. Dr. Maclagan suggests its propriety

[1] Am. Journ. of Med. Sci., Jan. 1852, from Lond. Med. Gaz.
[2] Bull. de Thérap., lvi. 72, 120, 412.
[3] Lancet, 1837–8, i. 198.
[4] Month. Journ. of Med. Sci., Aug. 1851, p. 158.
[5] Bull. de Thérap., xlv. 270.
[6] Lancet, 1833–4, ii. 863.

o relieve the *suppression of urine* which sometimes attends the tage of reaction. The danger of reproducing the primary disease vould appear to be greater than the prospect of relieving the sympom alluded to. Colchicum has been recommended in the treatnent of *tetanus*, by Dr. W. G. Smith, of Port au Prince.[1] As he ured but five out of nine cases, and one only of these belonged to he traumatic variety, his results are not very encouraging, particuarly as in the successful cases he employed local depletion and ounter-irritation to the spine. In the rheumatic form of the disase, the medicine might, perhaps, be useful. Burdach recommends he following formula as a specific in cases of *facial neuralgia:* ℞.—'orrosive sublimate, muriate of ammonia, of each, gr. j; water, ℥j; rine of colchicum seeds, ♏lxxx.—M. S.—Thirty to sixty drops very two hours. It is added, however, that each dose of the aedicine should be followed by a draught of the decoction of the roods; and also, that "to assist the cure" the local application of 'eratria ointment is sometimes ordered.[2] In some *cutaneous affec-'ons* the medicine has been employed with advantage. Dr. Elliot-on cured a case of *prurigo* in the course of three weeks, in a man eventy years of age, by giving half a drachm of the wine of colhicum three times a day. In those numerous cutaneous affections, f a scaly sort, in particular, to which gouty persons are subject, his medicine would probably be of advantage, particularly if comined with alkalies. In *gonorrhœa*, and also in *leucorrhœa*, it is aid to have been used with advantage by Ticinus, of Dresden, and lso by Mr. Ritton.

Externally, frictions with tincture of colchicum have been recomnended in *gout* and *rheumatism*, by Gumpert,[3] by Wansbrough,[4] and y Laycock.[5] It would appear in some cases to have afforded very reat relief. This preparation has also been used to destroy *vermin* nfesting the head and pubes.

Administration.—The dose of the *dried corm* is from two to ight grains, which may be repeated every two or three hours until s specific effects are obtained. By some persons it is considered he most efficient form of the medicine. Of the wine of the root, nd of either fluid extract, the dose is stated at from *ten minims* to *fluidrachm;* of the wine of the seeds, at from *half a fluidrachm* *two fluidrachms*, and of the tincture about the same. The dose f acetic extract of colchicum is *one or two grains.*

POTASSII BITARTRAS.	Vid.	*Cathartics.*
SODII BORAS.	"	*Irritants.*
SPIRITUS ÆTHERIS NITROSI.	"	*Diaphoretics.*
LIQUOR AMMONII ACETATIS.	"	"
DULCAMARA.	"	*Narcotics.*
OLEUM TEREBINTHINÆ.	"	*Stimulants.*

[1] Am. Journ. of Med. Sci., xvii. 66.
[2] N. Amer. Med.-Chir. Rev., iii. 730.
[3] MÉRAT and DE LENS, Dict., ii. 361.
[4] Lancet, 1836–7, ii. 662.
[5] Med. Gazette, xxiii. 899.

EMMENAGOGUES.

EMMENAGOGUES are medicines which promote the discharge of the menses. It is more convenient, however, to embrace under this title all medicines which are employed to influence the uterus, as well in the unimpregnated state as in pregnancy, and whether its functional activity be above or below the normal standard. Without such an extension of the meaning of the term, it may be doubted whether a true emmenagogue exists; and yet it is of the highest practical importance for the physician to be acquainted with the means which are at his disposal for restoring or regulating a function which is one of the most important, if not altogether the most so, in the female during the greater part of her life. It is the sign of her fitness for fulfilling the chief end of her earthly existence, the propagation of the human species, and its varying conditions, more than those of any other function, are the index and the measure of her health.

It was customary, until a very recent period, to consider all of the disorders which are usually associated with derangement of the menstrual function as its direct consequences, but later and more accurate observation has rendered it probable that in the greater number of cases the uterine disorder is secondary, an effect of general morbid causes involving the whole system, rather than itself a cause of constitutional disease. But this proposition must not receive too wide an extension, since nothing can be more certain than that a suppression of the menses sometimes induces a state of unequivocal and prolonged ill health, which terminates only upon the restoration of the catamenial flow. Apart from all other reasons, we may very safely believe that the cessation of a copious discharge of blood recurring every four weeks must seriously affect the health, for we know very well that in the male sex a much slighter interference with an habitual hemorrhage is often followed by serious or even fatal results. But we should form a very inadequate notion of the catamenial flow by regarding it as merely mechanical in its influence. It is, on the contrary, a sign of a revolution in the uterine system, which prepares for fecundation the germ of a new being, and arouses the sympathetic action of every organ in the economy. During this periodical phase of her life woman is no longer the same. Intellectually, morally, and physically she presents new aspects and acquires new powers; her appearance, her manner, and her disposition are changed, and, if no morbid influence disturbs the course of nature, she foreshadows in her condition the phenomena which she often exhibits while preparing for the great work of maternity.

Whether it depends upon the mere sympathies of the rest of the economy with the reproductive organs, or whether the excitement

of these organs is itself a local manifestation of a general æstus, it is certain that the whole system is in a state of effervescence, and that immediately before the menstrual flow begins a plethoric condition is denoted by fulness of the head, oppression of the breathing, tension of the pulse, and a sense of pressure in the loins and in the pelvic region. The nervous system is unusually susceptible to both pleasurable and painful impressions, there is an unwonted propensity towards the sexual act, the appetite for food is keener than usual, the bowels are apt to be confined, and the discharge of urine is less abundant. With the appearance of the menses this vital turgor in some degree subsides, and disappears with their cessation, leaving behind a languor which gradually wears away, and is followed by increasing vigor, until the succeeding catamenial period carries it to its height and allays it by the customary discharge.

It is impossible that any cause which, in an otherwise healthy system, directly interferes with the accomplishment of such a function, should not sensibly derange the economy, giving rise especially to an exaggeration of the usual plethoric phenomena, and to an aggravation of the disagreeable sensations which have been mentioned, and even to fully-formed hysteria. Thus, when the os tincæ is too narrow, as often happens at the age of puberty, and continues to be so until after a child is born, or when any other physical impediment, such as a fibrinous clot in the uterus, interferes with the discharge of the blood, the effort to overcome it frequently occasions the severest form of dysmenorrhœa, with pain in the uterus and ovaries, the back, groins, and thighs, and various reflex phenomena in distant parts, such as headache, neuralgia, delirium, spasm, etc. But all of the latter or excited symptoms may exist independently of pelvic pain. In many cases, on the other hand, an equally marked general derangement may be produced by menorrhagia, or an excessive menstrual flow, when it is dependent upon a premature or precocious development of the sexual function, such as occasionally takes place in temperate climates, and is very frequent within the tropics, or when it results from an untimely stimulation of the genital organs by sexual intercourse or other excitants of these parts. But both scanty and excessive menstruation are frequently, and, it must be admitted, even more frequently, dependent upon causes remote from the uterus itself, but by the operation of which this organ suffers in common with the rest of the economy. Yet, even under such circumstances, whatever treatment may be employed, and however successful it may be in re-establishing the general health, that result is never complete and permanent unless the catamenial flow is at the same time restored to its normal condition. This is most strikingly the case when it has been entirely suspended by causes which do not necessarily involve organic changes, such as cold, and mental impressions. But in proportion as a suspension of the discharge has resulted secondarily or indirectly from causes acting through the general system, will the return of the menses tend to

coincide with that of a healthful condition of all the vital organs. Such is the case when the blood is impoverished by a waste of its elements, as by hemorrhage or depletion, by diarrhœa, hydruria, diabetes, or suppuration; or when it is impaired by a deficiency of food or a want of assimilative power, as in typhus and yellow fever, scurvy, or anæmia from starvation, scrofula, etc.; while in other diseases, such as phthisis, cancer, etc., affecting the whole organism, or exerting a local and mechanical injurious influence upon the uterine system, as cancerous and other tumors of the ovaries or uterus, the duration of the catamenial derangement must usually be permanent, for the cause of it cannot be eradicated.

In looking, then, at the several groups or categories into which cases of menstrual derangement may be divided, we may exclude those which are dependent upon incurable organic disease, or only regard them in so far as they involve one of the elements contained in the other groups. Thus, in advanced phthisis, which is incurable, the immediate cause of the amenorrhœa which so often accompanies the disease does not differ from that which produces it under the influence of loss of blood and numerous debilitating causes, and which is mainly denoted by a remarkable falling off in the proportion of the red corpuscles of the blood. All of the other groups may be arranged in two classes, one of which contains the emmenagogue agents which restrain, and the other those which produce, excitement. The former are adapted to all of the cases in which a congestive element prevents the due performance of the function, and the latter to those much more numerous instances of torpor, whether strictly local, or arising in connection with constitutional derangement.

Sedative emmenagogues are exclusively agents which tend to diminish the amount of blood in the pelvic viscera. They may consist of general or local depletion, sedative emetics, saline cathartics, and revulsives, including the general warm bath, the hip-bath, and the foot-bath. They are best adapted to the treatment of recent cases of arrest of the menses by cold, mental emotion, or some acute disease; but, even when the affection is chronic, are not to be neglected whenever a menstrual nisus occurs. Under such circumstances they may be used in conjunction with stimulant emmenagogues, either to moderate their action, or to sustain and promote the sanguine afflux towards the uterus which they may have initiated. It will be observed that among sedative emmenagogues some are direct in their action, as leeches applied to the vulva or the os uteri, cupping the sacrum, saline purges, the hip-bath, and warm fomentations applied to the hypogastrium or the pudendum; while others, such as general bleeding, mercury, the foot-bath, and emetics, operate more directly.

Stimulant emmenagogues are also either direct or indirect in their action. Most of the aromatic plants are regarded as possessing a degree of emmenagogue power, which they exert, as they display their diaphoretic virtues, by stimulating the whole economy. The most commonly employed among them are dittany, chamomile,

horehound, and mugwort, but these are inferior in power to several others which appear to have a specific operation upon the uterus. Such are milfoil, tansy, and rue. The physiological stimulants, air, exercise, food, baths, electricity, and finally marriage, must not be forgotten among the stimulant agents of this class.

Still more direct as emmenagogue medicines are ergot, madder, borax, guaiacum, and belladonna. The first of these, although best known as an agent for exciting contractions in the gravid uterus at term, is not without an influence upon the unimpregnated organ. Madder, guaiacum, and borax are analogous to it, but feebler in their operation; and belladonna has the valuable property of causing relaxation of the rigid os uteri in tedious labor and in painful menstruation. Ether and chloroform have the same effect.

Of indirect emmenagogues of the stimulant class, the most important is iron, because it is the specific remedy for anæmia and anæmic chlorosis, which are generally associated with, and often the cause of chronic amenorrhœa. Next to it stand acrid purgatives, as black hellebore, aloes, savine, and gamboge, and irritant diuretics, but especially cantharides. An agent which should be included in the present class, is stimulation of the mammæ by suction, by the cupping-glass, or by certain substances, as the leaves of the castor oil plant.

Of all the remedies which have been mentioned in the preceding paragraphs, but one will be found treated of as the representative of the class of emmenagogues. Ergot is the only medicine whose properties in relation to the uterus are more important than those which it exercises upon other parts of the system. This fact may afford an illustration of the remark already made, that it has been doubted whether a true emmenagogue exists. Even ergot possesses this quality, in its restricted sense, in a very slight degree only. Yet it is useful both to know under what conditions attempts to regulate the menstrual function must be made, and what are the agents, and their peculiar powers, which are the most appropriate in each particular case.

ERGOTA.—ERGOT.

Description.—Ergot (*seigle ergotisé*, or spurred rye; *Mutterkorn*, or womb-grain) is a metamorphosis of rye, or other cereal, by which it is converted wholly or in part into a curved, purplish-black, cylindrical, tapering, and grooved excrescence, from one to three lines in diameter, and usually from six to ten lines long. When dry it is firm and brittle, but is flexible and tough when moist, and emits a sickening, heavy smell. Its color internally is white, with a slight tinge of pink. Its taste is nauseous, and somewhat acrid. This product is officinally described as "the sclerotium of claviceps purpurea, replacing the grain of secale cereale."

Ergot is produced by other cereals besides rye. Mialhe found that the ergot of wheat is identical with that of rye in the qualities of its proximate principles, and in its action upon the gravid uterus.[1] His conclusions have been confirmed by Pourcher,[2] and by Jobert.[3]

The natural history of ergot was very zealously investigated by Mr. Quekett, whose essay upon the subject the reader may consult with profit.[4] He was, however, preceded in his interpretation by De Candolle, and by Leveillé, in France. The former held that ergot is a fungus, and the latter endeavored to explain its development. In a Memoir presented to the Parisian Academy of Medicine, Baudelocque set forth the views of Leveillé, which are summarily that ergot is a fungous growth which usurps the place of the unfecundated ovary of the grain. It is generally, as its name implies (*ergot*, a spur), of a somewhat conical or nail-like figure, slightly curved, and longitudinally furrowed, from half an inch to an inch and a half long, and from half a line to three lines thick, and of a grayish violet color. It is solid, flexible, and rather tough, but breaks with a short fracture, and discloses a homogeneous dull white interior. When fresh it exhales a very penetrating and sickening odor, which has been compared by some to the smell of certain poisonous mushrooms, and by others to putrid fish, but which grows much less powerful by drying. When chewed it has an acrid and disagreeable taste, and its powder is very irritating to the nostrils.

Ergot has several constituents, one of which is known as the alcoholic, and another as the watery extract, neither of which displays any very active properties in the usual and normal state of the system. It also contains a resinous matter which acts chiefly upon the stomach and bowels, and an oil upon which its poisonous properties seem to depend. It is said by Kluge, and by Green, to be more active when gathered from the standing grain at harvest time, than when collected after harvest.[5] Arnal asserts that it is more active when old than when fresh. He affirms that it undergoes, by keeping, a fermentation which develops its virtues, provided it be not exposed to the air.[6] Leteurtre gives several cases which show that ergot may be kept for two and even five years without any apparent loss of its ecbolic properties. But this statement is not in harmony with general experience. The hæmostatic virtues of the drug are referred by Bonjean to an extract prepared with cold water, and by displacement, and from which the gummy matter is precipitated with rectified spirit. This extract, although it has no claim to rank as a proximate principle, he denominates *ergotin*, as Wiggers had previously given the same name to an extract prepared with boiling alcohol. To it, also, Bonjean attributes the power of ergot in the gravid and distended state of the uterus.

[1] Bull. de Thérap., xxxix. 41.
[2] Ibid., xlviii. 467.
[3] Am Journ. of Med. Sci., Oct. 1856, p. 479.
[4] Lond. Med. Gaz. (1836), xxiii. 606.
[5] Beck, Obs. on Ergot, p. 6.
[6] Bull. de l'Acad. de Méd., xiii. 680.

It may here be mentioned that, as early as 1831–2, Dr. C. Hooker, of New Haven, demonstrated that ergot deprived of its oil retained all its parturifacient virtues unimpaired, while it ceased to act unfavorably upon the child. Ergotin, as prepared by Bonjean, is a soft, reddish, and homogeneous substance, of a sour and acrid taste, and with a smell of roasted meat, due to the osmazome it contains. The preparation so called by Wiggers is a fine, reddish-brown powder, which has a peculiar and repulsive but aromatic odor, and an acrid, bitter, and aromatic taste. Several other substances regarded as proximate principles have been detected in ergot, as secalin or propylamin, ecbolina, ergotic acid, etc., but in the present state of the investigation, there appears to be no reason why a preparation containing all of the active properties of ergot should not be preferred to any of its isolated constituents.

The officinal preparations of ergot are:—

EXTRACTUM ERGOTÆ FLUIDUM.—*Fluid Extract of Ergot.*

Sixteen troyounces of ergot in fine powder are treated by percolation with a mixture of glycerin four fluidounces, and half a fluidounce of acetic acid with alcohol and water, to the production of sixteen ounces of fluid extract. Dose, five to ten minims.

VINUM ERGOTÆ.—*Wine of Ergot.*

This wine is made by mixing four fluidounces of fluid extract of ergot with twenty-eight fluidounces of sherry wine, and filtering. Dose, from one to three fluidrachms.

History.—According to Leteutre[1] several historians of the tenth century describe, under various names, such as *Ignis sacer*, *Ignis plaga*, *Ignis occultus*, etc., an epidemic disease which presented many of the characteristic phenomena of ergotism. The earliest mention of ergot as a cause of disease was by Sigebert de Gremblour, who wrote in 1096. Lonicer, in 1565, described it under the name of *clavus siliginis*. A few years afterwards (1576), the Medical Academy of Marburg attributed to this substance a spasmodic disease which then prevailed in Hesse. It seems to have been known in Germany as a popular oxytocic from a remote period, a fact which is attested by its vulgar names of *Mutterkorn*, already cited, and *Gebär Pulver*, or *pulvis parturifaciens*. In 1688, Camerarius stated that the midwives of Wurtemberg employed it to facilitate delivery. It seems probable that a Dutch accoucheur, who, in 1747, used a medicine capable of greatly hastening labor, was aware of the efficacy of this substance. "I make use," said this writer, "of a medicine the second dose of which never fails to bring on labor-pains and to convert false into true ones, so that the expulsive efforts become more efficient, and the dilatation of the *os uteri* advances; often, when nothing was lacking to bring a labor to a favorable termination, this medicine has proved effectual without any instrumental assistance." (*Leteutre.*) In France, according to Bordeu, it

[1] L'Histoiré du Seigle Ergoté, Paris, 1871.

was used from time immemorial to increase uterine action. In Italy, too, as Balardini assures us, the midwives employed it in difficult labors. Laneri and Amoretti make the same statement.[1] From a letter of Parmentier to the Abbé Rozier,[2] in 1774, it would seem that a thimbleful of powdered ergot was used as a popular remedy in Alsace, when the pains of labor were lingering and the presentation natural. In the same year its use was interdicted in France. But in 1777, Desgranges, an accomplished accoucheur of Lyons, extolled its efficacy, published many luminous reports of its activity and usefulness, and eventually succeeded in bringing it into general use.[3] Nevertheless it did not find favor with physicians, and was well nigh forgotten by them for nearly half a century.

Meanwhile it came into notice under more favorable auspices in America. For this we are indebted to the late Dr. Stearns, of New York. In 1807 he sent from Waterford, N. Y., to a correspondent, a sample of what he called *pulvis parturiens*, describing it as a spurious growth of rye, and stating that he had for several years used it successfully to expedite lingering parturition when the *pains had subsided, and were incompetent to expel the fœtus.*[4] In this communication he dwelt upon the necessity of first ascertaining that there is no obstacle either in the position of the child, or the state of the maternal organs arising from an imperfect opening of the os tincæ, or rigidity of the other maternal parts. He found the decoction more active than the powder. This account was soon confirmed by Dr. Akerly, of New York, who also mentioned his having heard of its use by women in New York and Connecticut, for the purpose of procuring abortion.[5] In 1813, Dr. Prescott called attention to the rapidity of its action, and stated that it began to operate within seven minutes after being taken.[6] Now, for the first time, arose the suspicion, afterwards so generally entertained, that it endangered the life of the child by causing a too violent and unremitting compression of its body.[7] The notice of its virtues by Chapman, and the more detailed account of its properties by Dewees in 1817–18, contributed still more largely to recommend and to diffuse its employment. In 1821, Dr. Atlee, of Philadelphia, reported his great success with it in threatened abortion, which the usual remedies could not prevent, and which excessive hemorrhage rendered alarming; in cases of hemorrhage near the end of gestation, connected with atony of the uterus, and in lingering labors without any physical obstacle to their completion. He also described its benefits in hemorrhage after labor from imperfect contraction of the womb.[8]

In France, although the American observations were known, they were generally discredited, because Chaussier and Madame La

[1] Annales de Thérap., ii. 50.
[2] Journal de Physique, iv. 144, and Eclectic Repertory, ix. 260.
[3] WRIGHT, Edinb. Med. and Surg. Journ., Jan. 1840, p. 23.
[4] Med. Repository, ii. 308.
[5] Ibid., xii. 341.
[6] A Dissertation on the Natural History and Medicinal Effects, etc.
[7] N. Eng. Journ. of Med. and Surg., ii. 353.
[8] Am. Med. Recorder, iv. 141.

Chapelle pronounced the medicine inert, nor was this prejudice overcome until the cases presented by Bigeschi to a medical society of Paris, in 1823, succeeded in attracting a closer attention to the subject. In England, too, authority was allowed to outweigh experience. Ergot was introduced into that country in 1824, but its acceptance was hindered by a letter from Dr. Hosack, of New York, to Prof. Hamilton, of Edinburgh, in which the former accused it of being *pulvis ad mortem*, rather than *pulvis ad partum*.[1] Even in 1825, Dr. Davis declared, somewhat disingenuously, that, although the pretensions of the medicine had been known to the profession for nearly twenty years, yet the actual fact of its power had not been satisfactorily established.[2] In the same year, however, Dr. Henry Davies published many cases which fully demonstrated its efficacy, and put to shame the hasty conclusions of too sceptical or too prejudiced physicians.[3] Within three years afterwards, so large a mass of testimony upon the subject accumulated, as to set at rest the question of the virtues of ergot. Of these proofs, the most elaborate and conclusive was the Essay of Michell,[4] published in 1828, and that of Villeneuve, abridged by Dr. Adam Neale, in the same year.[5] The exaggerated estimate of its virtues by the former writer was that of a partisan, as may be inferred from his opinion that, "as soon as it is generally known in female practice, it will supersede the necessity for male practitioners, except in very few instances."

Action. *On Animals.*—Several experimenters have called attention to the remarkable aversion shown by *dogs* to food containing ergot. Tessier says they would rather die with hunger than eat it. Gross found it impossible to make them retain any of it except by fastening the mouth, and even then a portion of it would be vomited through the nostrils. Wright, in his numerous experiments, introduced the medicine into the stomach through a gum-elastic tube. Diez noted as its principal effects profuse salivation, vomiting, dilatation of the pupils, hurried breathing, frequent pulse, cries, trembling, staggering, paraplegia, sometimes diarrhœa, sometimes constipation, prostration, urgent thirst, convulsions, and death. Similar symptoms were observed by Wright.[6] This experimenter injected a strong infusion of ergot into the jugular veins of dogs. The symptoms were dilated pupils, a rapid pulse, convulsions, and flaccidity of the limbs followed by their tetanic rigidity, which continued after death. When a weaker infusion was employed, it caused great temporary excitement, followed by depression. A still more diluted preparation seemed to exhaust life by a progressive sedative operation. Similar results ensued when the solution was thrown into the peritoneal cavity. The more gradual action of ergot upon

[1] Hosack's Essays, ii. 296.
[2] Med.-Chir. Rev., vii. 418.
[3] Ibid., viii. 276.
[4] On Difficult Cases of Parturition, and the Use of the Ergot of Rye.
[5] Researches respecting the Natural History, etc., of the Spur, or Ergot of Rye. Lond., 1828.
[6] Ed. Med. and Surg. Journ., lii. 319.

dogs was shown by Wright. He mixed from one to two ounces a day with the animal's food, and produced its death in the course of six or seven weeks. The succession of symptoms may be thus described. An immediate but temporary effect was shown by weakness of the hinder legs and dulness of vision, but day after day the animals grew duller, suffered from thirst, loss of appetite, and dryness of the nostrils. Then paralysis and anæsthesia of the hinder legs became more evident, the flesh wasted, acrid tears destroyed the hairs upon the face, sight and hearing failed, the heart was slow and feeble, the breath fetid, the stools and urine passed involuntarily, and death took place by exhaustion. The muscles were found on dissection to be pale and flabby, the heart was full of dark blood, the bronchial lining membrane and trachea were bathed in pus, the mucous membrane of the small intestine was injected. Tubercles were found in the lungs in some cases, and in some there were purulent collections in the joints.

In Tessier's experiments, ergot was mixed with the food of *pigs*.[1] They showed a reluctance to eat it. Its first effects were redness of the eyes and ears; the latter organs and the limbs then grew cold, the joints swelled, gangrene attacked the ears, limbs, and tail, and the animals died in convulsions. One of them, six months old, lived for sixty-six days. Its intestines are described as having been inflamed and gangrenous.

Parola[2] gave from half an ounce to two ounces daily to a *mule*. From the second day the pulse fell, the heart grew feeble, irregular, and jerking, the breathing slow and deep; the appetite and flesh failed; tremulousness, a staggering gait, and dulness succeeded. On the other hand, Block[3] fed a number of sheep and cows for several months together upon fodder containing a large proportion of ergot. No mischief whatever ensued. Supposing the experiment to be correctly stated, we can only account for the result by supposing that the ergot employed was quite inert.

The action of ergot upon *birds* is much more distinct and decided. Bonjean[4] gave two drachms daily of powdered ergot to *cocks* and *hens*. About the seventh day they became dull, languid, without appetite, and were affected with diarrhœa. In some cases the comb grew cold, bluish, flaccid, and covered with ecchymoses; in others it was ulcerated. Black blood flowed from the nostrils, the animals were unable to walk, their breathing grew slower, and emaciation and death followed. In other cases the plumage was shed, and the beak and claws were surrounded by a bluish circle. The experiments of Tessier on *ducks*[5] furnished results almost identical with these, and in a turkey the symptoms were precisely like those just described. Gross, of Breslau,[6] gave ergot, or else bread that contained either it or ergotin, to *pigeons*. At first they were disposed to vomit, but in the course of two or three days showed an

[1] Revue Méd., xliii. 140. [2] Annales de Thérap., ii. 89.
[3] WIBMER, Wirkung, etc., v. 85
[4] Traité Théorique et Pratique de l'Ergot de Seigle, Paris, 1845.
[5] Revue Méd., xliii. 138. [6] CANSTATT'S Jahresbericht, 1845, p. 255.

increased appetite. This, however, was followed by dulness, restlessness, or immobility, convulsive twitches of the muscles, diminished action of the heart and lungs, and death between the fourth and seventh day. Similar effects were produced in fowls and small birds, such as *linnets* and *sparrows*, the former of which died within forty-eight hours after eating fifteen or twenty spurs of ergot.

Bonjean gave three drachms of the *oil* of ergot to a rabbit; it appeared distressed and feeble, and was afterwards convulsed, with opisthotonos. To birds it generally proved fatal, but first produced symptoms of narcotism. Six-drachm doses were not fatal to dogs, but occasioned in one case spasmodic symptoms, and in another only nausea and drowsiness. The earlier experiments of Wright with oil of ergot gave similar results to these.

The lesions produced in animals by chronic ergotic poisoning may be thus summarily described. The venous system is engorged. In poultry, the general color of the comb and wattles is purplish with small blackish points, and the edges of these appendages are always quite black, and sometimes also hard and brittle. The gastro-intestinal mucous membrane is usually injected, particularly at its upper portion, sometimes softened, and occasionally ulcerated and gangrenous. In birds, the gizzard is soft and vascular; the liver is generally enlarged, and its consistence is sometimes diminished; the meningeal vessels are usually injected, and the brain and spinal marrow, in a small proportion of cases, softened; the lungs are congested, and the blood is liquid and black; in nearly every case the muscles are rigid for some time after death; in some instances this condition is permanent, especially in the hinder limbs of quadrupeds.

The influence of ergot upon the gravid uterus in animals is not uniform. In some cases it seems to have been purely negative, in others to have destroyed the product of conception without producing its expulsion, and in still others, and these are the most numerous, to have caused abortion. Bonjean gave ergot to a female *guinea-pig* during the early stages of gestation. Abortion was not occasioned, nor, indeed, any symptoms whatever; so that the result of the experiment was purely negative.[1] The experiments of Wright were to this effect. He mixed ergot with the food of a pregnant rabbit; no tendency to abortion was excited, and in due time six healthy young ones were born. The animal, still kept upon the same food, was again impregnated. She looked drowsy and moped, the fur grew erect and rough, gestation was *protracted* beyond its usual term, and three young ones were born, two of which were dead and the third survived but a few hours. Subsequently an abscess formed under the lower jaw, the front teeth dropped out, pus flowed from the eyes, diuresis and diarrhœa succeeded. In the twelfth week the animal died. The lungs and mesentery were tuberculous, but the intestines were sound. The same experimenter, after many trials of ergot upon pregnant bitches,

[1] Op. cit., p. 78.

concluded that it did not act as a parturifacient in them although it sometimes appeared to injure or destroy the product of conception.

On the other hand, according to Diez, it produced abortion in *bitches* and in *guinea-pigs* without harm to the mother or the young, when the dose was moderate; but large doses destroyed both, and excited inflammation of the womb. In 1825, Dr. Oslere gave ergot to a *sow*, a *cow*, and a *cat*, before the completion of pregnancy, and in each case produced abortion.[1] In 1841, an epidemic of abortion among *cows* occurred in the neighborhood of Trois-Croix, in France, which was traced to the ergoted state of the rye and other gramineæ in that district.[2] According to Percy and Laurent, a decoction of ergot injected into the veins of a *cow* caused the animal to calve speedily.

The following statement of Youatt shows conclusively that ergot acts upon the uterus of animals in labor precisely as it does in the case of the human female: "I have for the last six or seven years been in the habit of administering the ergot of rye to quadrupeds in cases of difficult or protracted parturition. . . . In the *monogastric*, if I may venture to use the term, I have never known it fail of producing considerable effect, even when the uterus has been previously exhausted by continued and violent efforts. In the *ruminant*, with its compound stomach or stomachs, I have witnessed many a case of its successful exhibition. . . . The uterus has in every case responded; it has been roused to a greater or less degree of renewed action."[3]

On Man.—In 1824 Lorinser and several companions took each of them two drachms of powdered ergot upon bread and butter. The symptoms in all the cases were alike, and consisted of some colic, nausea, and vomiting, salivation, occasionally diarrhœa, and a sense of fulness in the head.[4] Similar effects were obtained by Gross and an associate who each took a drachm of ergot.[5] And such also are the symptoms ascribed to the medicine by Raige-Délorme.[6] Trousseau and Maisonneuve, besides the above effects, particularly noticed dilatation of the pupils as the most constant phenomenon. It began within twelve or fourteen hours and continued for several days. The sight was not affected. Headache and vertigo, sometimes so marked as to resemble intoxication, and followed by drowsiness were also observed.[7] Hussa describes similar symptoms from bread made of flour containing a sixth or a fifth of ergot. The headache generally continued for several days.[8] Bonjean took a drachm of powdered ergot in three equal doses before breakfast, and found that the symptoms were precisely such as have been described.

[1] Phila. Journ. of Med. and Phys. Sci., xi. 106.
[2] Edinb. Month. Journ., Jan. 1842, p. 73.
[3] PEREIRA, Mat. Med. (3d Am. ed.), ii. 137.
[4] Edinb. Med. and Surg. Journ., xxvi. 453.
[5] CANSTATT'S Jahresbericht, 1845, p 256.
[6] Dict. de Méd., 2ème éd., xviii. 271. [7] Bull. de Thérap., iv. 106.
[8] Ibid., liii. 285.

Other testimony to the same purpose might be adduced, but it is scarcely necessary, since the results here cited were so uniform. It should be mentioned, however, that writers may be found, including Parmentier, Lalesque, Uberti, etc., who assert that ergot has no effect upon the healthy system, except, perhaps, to render the pulse less frequent.

The power of ergot to lower the *pulse* is unquestionable. In some experiments upon himself, Parola found that his pulse fell from 74 to 60, and from 79 to 72,[1] and Dr. Quinton Gibbon, of New Jersey, observed a decline of the pulse in himself from 70 to 57, and in another person, from 64 to 55. In this case a repetition of the trial produced the same result. Arnal's numerous experiments showed that the action of a drachm of ergot commenced within an hour, and in the course of four hours lowered the pulse from 84 to 62. After allowing for the influence of natural causes, the time of day, rest, etc., it appeared that the pulse was still lowered, on an average, eight beats in a minute. In febrile affections the influence of the medicine was still more marked, and sometimes the pulse fell thirty and even thirty-six beats in the course of five hours. The experiment upon the healthy system was four times repeated at intervals of ten days, and uniformly with the same result.[2] Bonjean found that a drachm of ergot lowered his pulse from 70 to 60. In parturient females Dr. Hardy observed that within fifteen or at most thirty minutes the medicine produced a marked diminution of the pulse which sometimes continued for several days.[3] Beatty estimated its reduction, under like circumstances, at twenty beats in a minute. According to Bonjean *ergotin* reduces the force, but not the frequency of the pulse; but Guilland and Arnal state that it does both.

The earliest experiments to illustrate the powers of *oil* of ergot were performed by Dr. Charles Hooker, of New Haven, in 1831–2. He obtained the oil by macerating ergot for several days in ether, decanting the liquid, and evaporating the ether. To a medical student he gave half a drachm at two o'clock P. M., a drachm at three o'clock, and the same quantity at four o'clock. Under the second dose the pulse fell from 82 to 65, and under the third dose to 36; and the respiration from 19 to 8. Of the general symptoms, the first was a sense of tightness followed by an unpleasant heavy and confused feeling in the head, and nausea like sea-sickness, general languor and lassitude, constant spitting, and vivid flashes of light before the eyes. Under the second dose there was, in addition, painful rigidity of the muscles, lassitude, lividity of the skin, dilated pupils, and a heavy countenance. Under the third dose there was, besides an increase of these symptoms, diuresis. The same phenomena were manifested in another experimenter, and in neither case did they entirely disappear for nearly a week afterwards. For three days the pulse continued under 50, the skin was

[1] Annales de Thérap., ii. 91. [2] Bull. de Thérap., xxxvi. 534.
[3] Dublin Journ. of Med. Sci., xxvii. 225.

still dusky, and the muscles sore. When the same oil was given in labor no influence whatever on the uterus was displayed, but upon the child a very marked impression, as will presently be seen. Dr. Hooker then used the ergot, from which the oil employed in the above experiment had been abstracted, and found that its ecbolic powers were entirely unimpaired.[1]

If the phenomena here described are compared with those produced upon man by ergot in large doses, it is evident that they are identical, and that the toxical effects of this substance are due entirely to the oil which it contains.

Mr. Wright also states that the oil of ergot lowers the pulse and renders it less frequent. It may also be mentioned here, that he found the vapor of this preparation diffused through the air of a close room produced a tingling sensation in the limbs, distressing lassitude, irritability, and giddiness.[2]

Schroff, in his experiments, observed that pure ergotin in doses of from one-third of a grain to one grain produced fulness of the head, headache, and dilatation of the pupils, followed by colic and infrequency of the pulse.[3]

Among the effects of ergot may be noticed those which are occasioned by the use of food containing a large proportion of this substance, and which are included under the general name of *ergotism*. The records of this disease have been traced back to classical times, but they are more clearly to be recognized in the descriptions of epidemics of dry gangrene, one of which was recorded by Sigebert de Gremblour, in 1096.[4] In 1597, a spasmodic disease which was attributed to ergoted rye, prevailed in Hesse and the adjacent territories. Epidemics of the same sort occurred in 1648, 1675, 1702, and 1716, in Germany, as well as in Flanders, and in France. In Sologne, a French province where rye is much cultivated, this disease has repeatedly been prevalent. Two forms of the affection have been described, the spasmodic and the gangrenous.[5]

Spasmodic ergotism begins with malaise, formication of the whole skin, cramps and numbness of the extremities, and pains in the head and back. This state lasts from one to three weeks, and ushers in heartburn, epigastric oppression, vertigo, syncope, deafness, paroxysmal or permanent flexure of the joints, or equally violent extension and opisthotonos, twitching of the facial muscles, in some cases violent delirium, with cold skin, intense internal heat, and fetid sweats. The attacks are sometimes preceded by digestive disturbance, and last from half an hour to two hours or more. After a time the convulsions cease. They are followed by exhaustion, debility, oppression, heartburn, and a ravenous appetite,

[1] Bost. Med. and Surg. Journ. (1834), x. 298.
[2] Edinb. Med. and Surg. Journ., July, 1840, p. 51.
[3] REIL's Mat. Med. d. rein. chem. Pflanzenstoffe, p. 166.
[4] GOUPIL, Journ. des Progrès, iii. 161.
[5] OZANAM, Maladies Epidem., iv. 226; BERGEN and Müller, HALLER's Disputations, i. 78; DUVIVIER DE SAINT HUBERT, Traité Philosophique des Maladies épidemiques, etc., Paris, 1836; HEUSINGER, Studien über den Ergotismus, Abstract in Journ. f. Pharmakodyn., i. 404.

which it is dangerous to gratify. Sometimes strabismus or loss of sight succeeds,[1] with an eruption of bullæ upon the skin, or general insensibility. After death in fatal cases, the stomach and bowels are found inflamed, and the parenchymatous organs congested. The attack usually lasts for three or four weeks, and is very fatal, but less so than the gangrenous form, and those who recover are sometimes affected with paralysis which may be permanent. In 1735, during an epidemic in Wurtemberg, out of five hundred persons attacked, three hundred under fifteen years of age perished.

The *gangrenous* form of ergotism is quite different from the foregoing. The first symptom is a dull pain and weariness of the limbs with a heavy and stupid expression of countenance. The skin has an earthy or jaundiced hue. The extremity of the nose about to become affected grows quite cold, and the skin over it is of a dusky red color. The gangrenous process generally begins in the central parts of the limb, and afterwards attacks the skin, extending upwards towards the trunk from the fingers and toes, causing these parts to blacken, shrivel, and harden, until they resemble the flesh of a mummy. Sometimes, however, they present the appearance of ordinary gangrene. In either case the finger, the toe, the nose, or even the extremity separates itself from the body without hemorrhage, leaving a clean wound behind. Sometimes the flesh only is thrown off, and the bone has to be divided artificially. Cases are reported in which all four of the extremities were thus lost. Meanwhile the digestion is not always deranged, although death is sometimes preceded by diarrhœa. The attack is seldom shorter than three weeks, and in the vast majority of cases is fatal.

It is proper to state that the dependence of these epidemics upon ergot has been denied by several writers, among whom, as of current authority, Trousseau and Pidoux may be mentioned,[2] but the weight of evidence is altogether on the opposite side. Among the more recent affirmative proofs, two may be cited, as each illustrates one of the forms of ergotism above described. In 1841, a family of eight persons lived upon heavily ergoted rye bread, which was gathered during the wet harvest of the previous year. The chief symptoms were these: malaise, anxiety, exhaustion, faintness, coldness of the whole body, a sharp, pricking pain and formication, numbness of the hands and afterwards of the arms, alternating with spasms, which were so severe as to extort tears. The muscles of the lower extremities were affected in the same manner, and in one case those of the right side of the face; subsequently the abdominal muscles were spasmodically contracted. About the sixth day, nausea, vomiting, and diarrhœa took place, with severe pains in the bowels and bladder. About the fourteenth day, two of the children lay as if stupefied, or if roused raved wildly, or complained of pains in the head and limbs; at the same time a

[1] MEIER, of Kronstadt, has shown that cataract is a very usual consequence of chronic ergotism. See Archives Gén. de Méd., Mars, 1863, p. 350.
[2] Thérapeutique, 3ème éd., i. 807.

pruriginous eruption appeared on the skin. They died on the twenty-first day in violent convulsions.[1] The other case is reported by Bonjean.[2] Like the former, the sick family consisted of eight members. Of these, four were not affected, two were but little so, and of the remaining two, one perished and the other lost his leg. All of them had lived upon the same ergoted bread. In the fatal case the symptoms were these: pain in the left groin; a dark spot on both calves; coldness and pain in the legs, followed by an eruption of vesicles, with violent itching; gangrene of the lower third of both legs. In three weeks, the sphacelated parts began to separate; the feet were black and dry; the upper part of the legs were affected with humid gangrene; both were amputated below the knee; very little blood flowed. No extension of the disease followed, but the patient died of pneumonia, which was probably metastatic. In the other child but one leg was attacked; its symptoms were the same as in the first case, but spontaneous separation of the limb at the knee took place, and recovery followed.[3]

Some experiments of Bonjean appear to show that the process of fermentation in making bread and the action of heat in baking it diminish greatly the activity of any ergot it may contain. Hence, he says, the crust of such bread is less injurious than the crumb.[4]

Uses. *In Labor.*—Dr. Stearns, soon after his introduction of ergot into medical practice, so far from advocating its habitual employment, stated expressly that he had not found it necessary in more than one out of thirty cases. The indications for its use, as given by him, are the following: 1. In lingering labors when the child is low, the parts relaxed, the pains absent or feeble, and there is danger of delay from hemorrhage or other alarming symptoms. 2. When the pains are suspended and convulsions set in, premising venesection. 3. In inevitable abortion. 4. When the placenta is retained by uterine inertia. 5. In post-partum hemorrhage under like circumstances. Subsequent experience has confirmed the soundness of these rules, and has not made any essential addition to them. Obstetricians have clothed them in every form of language, but without altering their spirit. The only question which may admit of different solutions is, at what period of the passage of the child through the pelvis is the administration of ergot advisable? The more prudent and skilful tend to restrict its use. Thus, Dr. Meigs says that he scarcely gives ergot as an

[1] ASCHOFF, CANSTATT's Jahresbericht, 1844, p. 240. A case of the same sort was presented by a family of seven persons in the village of Envers, Upper Savoy. Bonjean, op. cit., p. 146.

[2] Op. cit., p. 158.

[3] A case occurred in Ireland of ergotic gangrene. *Vid.* TAYLOR, Med. Jurisp. (1st Am. ed.), p. 432.

[4] The fullest account of epidemic ergotism will be found in the paper of Mr. WRIGHT, in the Edinb. Med. and Surg. Journ., lii. 207; and besides this and the papers referred to above, the reader will find an interesting abstract of its history by LASEGUE in Archives Gén., Mai, 1857, p. 594. A brief notice of an epidemic at Lyons in 1854 is given in the same journal, Nov. 1855, p. 605; and "A Supposed Case of Ergotism," with interesting historical details, is published by Mr. CAMPS in Brit. and For. Med.-Chir. Rev., Jan. 1855, p. 196.

pulsive agent. He chiefly employs it at the moment of, or just efore, the birth of the child, in order to secure a good contraction f the womb in women who are known to be subject to hemorrage. To administer it merely for the purpose of hastening natul labor and abridging the attendant's weariness of waiting is holly inexcusable, and argues a culpable ignorance of the powers f the drug. We shall consider in succession its action upon the *other* and upon the *child.*

Several writers have called attention to a painful, spasmodic, nd, as it were, tetanic contraction of the gravid uterus provoked y ergot, which, so far from indicating an expulsive effort on the art of the organ, shows directly the reverse. To this action, it ay here be stated, a share of the disastrous influences of ergot on e child is fairly to be attributed. Dr. Hardy has drawn attenon to the fact that, when ergot is used, the volume of the uterus often found much greater than after ordinary labors, imparting the hand almost the feel of a uterus before the expulsion of the acenta. It is at the same time hard, and remains so for several ays.[1] It is sometimes stated that ergot may occasion rupture of e uterus. Several cases of the sort are reported. One is upon earsay evidence, and occurred in the hands of a medical student.[2] nother was under the care of a midwife.[3] A third was in similar ands.[4] Of three cases of rupture attributed by M. Dépaul to ert, one was in a female with spinal curvature, and treated by a idwife, and the medicine was prematurely administered; in a cond, the rupture did not take place until four or five hours after e administration of two doses, each of only ten grains; in the ird case only do the conditions appear to have been suitable for e employment of the drug.[5] Another instance of this accident curred in the practice of a physician, who, after having administered ergot in two doses of about eight grains each, was absent om his patient for several hours, during which the rupture ocrred.[6] In all but one of these cases the medicine was administered in direct opposition to the rules which should govern its emoyment, and yet its agency in producing the result is not clearly monstrated, since uterine rupture is known to take place quite dependently of ergot. Indeed, when the third case referred to as reported to the London Medical Society, the operation of this use was by no means admitted. And, on the other hand, if we amine the immense number of cases in which the medicine has en used, we shall scarcely find any in which it can even plausibly charged with the accident in question. Even in a case which came the subject of medico-legal investigation, after death from ortion and hemorrhage, and in which it was decided that the tal issue was attributable to ergot, the quantity of this substance hich had been taken was unknown, and it also resulted from the

[1] Dublin Quart. Journ., xxvii. 230.
[2] Armstrong, Lond. Med. Gaz., July, 1838, p. 734.
[3] Coward, Ibid., Nov. 1840, p. 272.
[4] Hooper, Lancet, March, 1837, p. 824.
[5] Abeille Méd., x. 93, etc.
[6] Bull. de Thérap., xlviii. 351.

testimony that eight days previous to her abortion and death the woman had fallen heavily upon her nates.[1] So that even in this case it cannot be said that ergot was a mortal poison.

Dr. Catlett attributes puerperal convulsions, in some cases, to the action of ergot, as well as the production of hourglass contraction of the uterus.[2] Rupture of the perineum, and laceration of the os uteri have likewise been laid to its charge. According to Dr. Barnes,[3] prolapsus and procidentia of the uterus and bladder may result directly from the violence of ergotic contractions. He cites a case in which these organs were driven down so that the bladder appeared outside of the vulva. Still earlier, Dewees reported a case in which the too free use of ergot by the patient after miscarriage, caused the escape of a considerable portion of the uterus through the os externum.[4] Retention of the *placenta* is sometimes attributed to ergot, and apparently with good reason. During natural labor, the alternate repletion and evacuation of the placental sinuses is doubtless a chief cause of the separation of this organ from its attachment. The continuous and steady contraction produced by ergot, yet not going as far as that of natural labor, renders the retention of the after-birth more probable. Dr. Hasbrouck, of Rockland County, New York, has reported four cases of this accident, which suggest the explanation just given.[5] In addition to these effects, it may be mentioned that certain of the peculiar poisonous actions of the oil of ergot are sometimes manifested in the mother during labor, such as delirium and headache, dulness, incomplete coma, lividity of the countenance, muscular rigidity, etc.[6]

The influence of ergot upon the child is by far the most important question that relates to this medicine. At the commencement of its use we had the high authority of Dewees for believing that there was no decisive instance of its having a direct and unfriendly influence on the child. The cases to the contrary he held to be those in which it was given too early, when the soft parts were unrelaxed, or the head was not well situated. The same opinion was expressed strongly by Chapman.[7] But as early as 1822, we find Dr. Moore, of New York, stating that "it appears to be injurious to the child at all times, for in every case in which I have seen it exhibited, the child has been stillborn, and in the greater part of them it was not possible to restore it to life."[8] In 1828, Dr. R. M. Huston maintained that, even when given under all the favorable conditions admitted to be necessary, the medicine is still chargeable with the death of many children, and he refers to the experience of Church, Holcombe, Hall, and others, for a confirmation of this statement.[9] In 1834, Dr. Hooker, of New Haven,[10] used the

[1] CASPER's Vierteljahrs., xx. 177.
[2] Month. Journ. of Med., Feb. 1842, p. 209.
[3] Lancet, Oct. 1853, p. 434.
[4] Am. Journ. of Med. Sci. (1828), i. 258.
[5] N. Y. Journ. of Med., Nov. 1858, p. 324.
[6] MAUNSELL, Lond. Med. Gaz., xiv. 605. TRASTOUR, Brit. and For. Med.-Chir. Rev., Oct. 1857, p. 523.
[7] Therapeutics, i. 340.
[8] HOSACK's Essays, ii. 296.
[9] N. Amer. and Surg. Journ., vii. 81. See, also, BECK, Obs. on Ergot, p. 8.
[10] Boston Med. and Surg. Journ., x. 298.

oil of ergot in six cases of labor, which illustrate the peculiar operation of this constituent of the drug. In three of them twenty, thirty, and forty drops were given without effect. In the fourth case fifty drops were administered, and the woman complained of a strange sensation in the head. In the fifth case sixty-five drops, and in the sixth case seventy-five drops were used. In both the labors were easy, but "the children for a considerable time after birth had a livid appearance, and respired with much difficulty and irregularity, with the ordinary appearance of ergotism." In no case was there any increase of the uterine contraction. More recently Drs. McClintock and Hardy have said, "It by no means follows as a consequence that the ergot will not act upon the child, because it does not act upon the uterus, for we have seen numerous instances where the child was unquestionably affected by it, although the uterus was wholly unaffected or nearly so."[1] Signs of congestion in the fœtus were observed to arise from ergot by Lorenz, who ascribed them to the dose being too large, viz., fifteen to twenty grains.[2] Dr. Catlett maintained that it tends to produce hydrocephalus in the early stage of infantile life.[3]

All of the statistics, embracing many cases of labor in which ergot was employed, show a large proportion of stillbirths. Prof. Busch, of Berlin, administered it in 175 cases, on account of weak labor-pains, after the os uteri was well dilated. 177 children were born, of whom 17 were dead, and 18 in a state of asphyxia.[4] Again, Mr. Chatto refers to 420 cases of labor, in 80 of which ergot was exhibited. 422 children were born, of whom 31 were dead. 10 stillbirths occurred among the 80 cases treated by ergot, and 21 among the remaining 340 cases. So that the proportion of deaths in the former class was *one in eight*, but in the latter only *one in seventeen*.[5] In the report of Drs. McClintock and Hardy we find that out of 259 tedious and difficult labors, 173 deliveries took place without any instrumental assistance. "Of this number thirty got ergot to overcome inertia in the second stage of labor, and only *ten* out of the *thirty* children were born alive."[6] In other words, the proportion of deaths attributed to this agent was *one* in *one and a half*. Dr. R. U. West, in defence of ergot, has published an abstract of sixty-nine cases of labor in which it was administered.[7] Nine children were stillborn, or rather more than *one in eight*, a proportion regarded by Mr. Chatto as condemnatory of the use of this drug. These statistics leave no doubt of the fact that ergot administered before the close of labor has proved very destructive to the life of the child.

Is this danger inherent, or does it depend upon the conditions under which the medicine is employed? In seeking to find an answer to this question it may be stated, first, that a different result

[1] Loc. inf. cit. [2] DIERBACH, Neueste Entdeck, i. 135.
[3] Edinb. Month. Journ., Feb. 1842, p. 210.
[4] Neue Zeitschrift für Geburtskunde, Bd. xv., and Lond. Med. Gaz., xxiv. 337.
[5] Lond. Med. Gaz., xxiv. 575. [6] Dub. Quart. Journ., Feb. 1851, p. 36.
[7] Times and Gaz., Dec. 1855, p. 617.

from those just quoted has sometimes been obtained. Thus M. Godquin, comparing the success of ergot with that of the forceps, concluded it to be less injurious to the child. He draws this inference from an analysis of 1885 labors, of which 780 took place after he began to employ ergot. Previously, he had found it necessary to apply the forceps in 1 out of every 25 cases, and lost one child in 88; while subsequently he was obliged to use the forceps but once in 65 cases, and lost but 1 child in 260.[1] It may be said that the timely intervention of the forceps prevented the mischievous effects of the ergot: and this we suspect to be a just commentary upon the facts; for the state of the fœtal heart under the action of the drug proves clearly that the *duration* of this action is the chief source of danger of the child. As Dr. Beatty remarked, if it be short, the child will be born alive, but if it be delayed two hours, the child will be stillborn.[2] The danger from delay is manifold.

In a subsequent publication to that mentioned above, Dr. West admitted that his original conclusions were not drawn from a sufficiently large number of cases to establish a law, but claimed that his more recent, added to his earlier experience, presented a more favorable result. Thus in 241 ergot cases there were but 14 stillbirths from all causes, or nearly *one in seventeen.*[3] Dr. John W. Beck, of Ulster (Id.), states that in 296 cases in which he administered ergot, the child was born dead twenty times, or died very soon after birth, a proportion of about *one death in fifteen* cases,[4] or almost the same as that reported by Dr. West. In this country a distinguished practitioner and teacher of obstetrics, Dr. Storer, has declared that "he never knew deleterious effects to be produced by ergot, when its administration was clearly indicated."[5] These numerical results of observations, and this conclusion derived from a long and enlightened experience, are too important not to be allowed their full weight; but as, when they were originally announced, they met with an emphatic dissent from obstetricians of the highest character and ability, we cannot now accept them as representing the actual danger to which ergot exposes the life of the child during labor, so long as they are opposed by the opposite results derived from equally authoritative and more numerous sources.

Dr. Beatty is of opinion that ergot is capable of directly exciting fatal muscular spasms. He also reports six cases of which the distinguishing characters were general lividity of the surface, universal rigidity of the muscular system, producing stiffened limbs and clenched hands in those infants in whom life was extinguished, and a remarkable kind of alternating spasm and palsy in those that were resuscitated. It is true that Dr. Denham doubts the dependence of these symptoms upon ergot, remarking that children are sometimes born in a cold livid state, and more or less convulsed, when no ergot has been administered to the mother. But, it may

[1] Bull. de Thérap., iv. 127. [2] Dublin Quarterly Journal, xxv. 204.
[3] Times and Gaz., July, 1861, p. 72.
[4] Am. Journ. of Med. Sci., April, 1864, p. 541.
[5] Boston Med. and Surg. Journ., August, 1862, p. 18.

be rejoined, these symptoms were shown by Dr. Hooker to follow the use of oil of ergot, which has no influence on the contractile action of the womb. But, apart from this fact, the direct action of ergot upon the fœtal heart is no longer questionable. Dr. Hardy found that it diminished the frequency of the heart's pulsations, and sometimes produced irregularity and even intermittence of them. He observed, indeed, that when the number of the pulsations had been steadily reduced below 110, and were at the same time intermittent, the child was rarely saved. He was careful to note that this effect was sometimes quite independent of the compressive action of the uterus.[1]

The changes produced by ergot in the circulation within the uterus have been carefully examined by M. Dépaul. He has shown that during the contractions of this organ in natural labor, its peculiar murmur becomes altered in tone, and fainter, and sometimes even ceases to be heard. At the same time the fœtal pulsations grow hurried and feebler until the end of the pain, when both sounds resume their proper characters.[2] The intermittent action of the uterus appears to be intended to prevent the dangers of a suspended circulation in the uterine vessels, and it is only towards the close of labor when the head and chest of the child have been in a great measure released from the grasp of the uterus that the pains become more continuous and steady. But ergot excites tonic and continued contraction, so that the child's head and trunk are subjected to the unrelaxing pressure of the womb. No truce is allowed to repair exhaustion and permit fresh blood to fill the uterine and fœtal vessels. It cannot be denied, therefore, that at full term, and when the child is relatively large, its danger is increased by ergot, and that there is a rational ground, as well as a motive drawn from direct experience, why this agent should be charged with many deaths which a timely resort to the forceps would have prevented.

In France, the mischievous influence of ergot in childbirth became so strongly suspected that in 1845 the Prefect of the Seine addressed a communication in regard to it to the Academy of Medicine.[3] A committee appointed to investigate the subject reported in 1850 that ergot, when *imprudently* used, might injure the mother and destroy the child, by a direct sedative influence on its circulation, as well as by subjecting it to the prolonged compression of a rigidly contracted uterus.[4] The subject was again before the Academy in 1853, when the conclusions of M. Dépaul were adopted, that except in miscarriage, in certain labors attended with hemorrhage, and occasionally at the conclusion of natural labor, parturient women would be gainers by the complete disuse of ergot. M. Dépaul insists strongly upon avoiding ergot altogether when the fœtal circulation is weak or disordered.[5]

The discordant opinions, which we have recorded, of the influence

[1] Dublin Quarterly Journal, xxvii. 224.
[2] Abeille Médicale, Avril, 1853, p. 97.
[3] Bull. de l'Acad., x. 565.
[4] Ibid., xvi. 6.
[5] Loc. sup. cit.

of ergot upon the fœtus, may perhaps be reconciled by a reference to the doses in which it is administered. It seems very certain that the danger to which it exposes the child arises from the tonic contractions of the uterus which it induces, and to its powerful sedative action upon the fœtal heart. Hence, if its administration could be managed in such a manner as to stimulate the contractions of the uterus without rendering them uninterrupted, and without depressing unduly the fœtal heart, the benefits of the drug might be secured and the risks of its exhibition avoided. Indeed, as we have elsewhere recommended, an infusion containing the virtues of five or six grains repeated every five or ten minutes, will usually suffice. This method has recently been advocated by Dr. D. Dyce Brown, who says: "Given in this manner, in the majority of cases, after a single dose, uterine action becomes increased in from five to twenty minutes, and the pains exactly resemble normal uterine pains in their strength, duration, and period of intermission; in fact, they are what might be called laudable pains and no more. Sometimes the first dose seems inoperative. . . . In this case, after an interval of a quarter of an hour or twenty minutes, to watch its effect, the dose may be repeated a second time."[1]

The excessive action of ergot and the inhibitory operation of anæsthetics may also be made to modify one another, and hasten labor while rendering it painless. This valuable combination was first employed by Dr. Simpson, who associated tincture of ergot with ether. More recently Dr. C. C. Hildreth has extensively employed ergot and chloroform in the same manner, especially with a view of preventing post-partum hemorrhage, to which the use of anæsthetics predisposes.[2]

There is reason to believe that ergot is not less injurious to the child in *premature labor* than at full term, if not, indeed, much more so. It appears to endanger the fœtus more than when puncture or separation of the membranes is resorted to. Dr. Ramsbotham compares thirty-six such cases in which the latter expedient was adopted with twenty-six in which ergot was administered. Nineteen children, or more than one-half, of the former class, and four children, or less than one-sixth, of the latter class survived.[3] In 1847 Hoffmann extended the tables of Ramsbotham by adding new cases, and from the whole it appeared that twenty-seven out of thirty-eight children perished in premature labors in which ergot was employed.[4] The advantages to the mother are, however, very great, and leave no doubt of the propriety of resorting to the production of abortion or of premature labor by means of ergot, in connection with manual interference or not, as the circumstances may require. In his earlier practice Dr. Ramsbotham employed ergot alone. It had previously been used by Dr. James, of Philadelphia,[5]

[1] Times and Gaz., Nov. 1865, p. 492.
[2] Am. Journ. of Med. Sci., April, 1866, p. 361.
[3] Lond. Med. Gaz., xxiv. 421.
[4] Bull. de l'Acad., xiv. 19.
[5] Phil. Journ. of the Med. and Phys. Sci., xi. 114.

and cases of its success are related by Dewees, Weike, Paterson, Rigby, Heane, Churchill, Dubois, Müller of Stettin, etc.[1]

If, now, we examine the influence of ergot upon the gravid uterus in the *earlier stages of pregnancy*, and before quickening, when it is most likely to be resorted to with criminal intentions, we shall find that in proportion as we recede from the period at which the spontaneous action of the womb begins, ergot fails to exhibit its specific influence. In his report to the Academy of Medicine, M. Danyau says: "We do not believe that, independently of labor, of direct manipulation, or of some other external influence, ergot of itself can excite uterine contractions during the first half of pregnancy." Such, also, is probably the opinion of physicians who have had the best opportunities of studying the subject. It is, however, to be recollected that the distension of the uterus at this period is a normal condition, and it does not follow that an equal or even a less degree of enlargement should not have a different result when it depends upon morbid causes. This is the case in menorrhagia. It was so in a singular accident reported by Dr. J. E. Taylor, of New York. A female who was not pregnant, had some leeches applied to the neck of the uterus to relieve engorgement of that organ. One of them found its way into the cavity of the uterus, where it occasioned bearing-down pain and a bloody discharge. Ergot was administered, and a clot expelled holding in its centre a dead leech.[2] There is reason to think that, under certain circumstances, ergot may even prevent the progress of abortion when it depends upon a relaxed or debilitated state of the uterus, if the medicine is given in small doses. This may be inferred from several cases reported by Dr. Gardner, of New York. The patients, in an early stage of pregnancy, had been strained by lifting weights, or had received a blow upon the back. Blood was discharged per vaginam, and the os uteri was dilated, but there were no decided labor-pains. Small doses of ergot were administered, which appear to have arrested the hemorrhage and prevented miscarriage.[3] Still more to the point is a case reported by Mr. Ker, of a woman who had for several years suffered from prolapsus of the uterus with leucorrhœa. The prolapsus at length became complete and irreducible. Under the idea that the enlargement was of an asthenic nature, and might be relieved by stimulants, ergot was administered. The tumor then contracted sufficiently to admit of its reduction.[4]

Uterine Hemorrhage.—Ergot was early employed to check hemorrhage during or subsequent to labor. In the *Historia Plantarum* (1688) Ray speaks of the remarkable power of ergot to restrain the lochia, "singulare præsidium ad compescendum lochiorum fluxum." It was prescribed for this purpose in Philadelphia in 1821, by Eberle and Dr. Shallcross,[5] and soon afterwards by Goupil in France,

[1] DIERBACH, Neueste Entdeckungen, i. 139.
[2] New York Journ. of Med., Sept. 1853, p. 219.
[3] Ibid., p. 226. [4] Lond. Med. Gaz., xiv. 604.
[5] Am. Med. Recorder, iv. 218.

after which it came into general use. Its most obvious advantages are obtained when the uterus remains distended with coagula after delivery. In unavoidable hemorrhage from placenta prævia, Dr. Ramsbotham says that, when the uterus is flaccid, and the female exhausted, before the operation of turning is resorted to, diffusible stimuli should be given, and a dose or two of ergot.[1] A similar practice had been advised by Dr. Ward, of New Jersey, but Dr. Dewees condemned the practice strongly, unless the os uteri were dilated or easily dilatable,[2] as did also Dr. Jackson (of Northumberland), upon the ground that the state of the parts cannot be determined with accuracy.[3] The fluid extract of ergot has been used hypodermically for uterine hemorrhage by Lente, Schmid, and others.

Menorrhagia.—In the seventeenth century, ergot is said to have been used for this affection by Gaspard and Bauhin, and certainly no other remedy is more prompt and certain in its effects. In 1824, Dr. Hosack spoke highly of its virtues in menorrhagia connected with general or local debility.[4] Dr. Marshall Hall soon afterwards[5] illustrated its powers by the cure of a case in which, during the inter-menstrual periods, there was profuse uterine leucorrhœa. In Italy, Cabini and Sparjani (1831) reported ten cases of its success, and (1833) Negri five additional ones.[6] In 1842, Dr. Fife reiterated the original opinion that it was mainly adapted to passive asthenic cases, and that when plethora was present, bleeding and saline laxatives must be premised.[7] Three years later, Ebers, of Breslau, found that *ergotin* promptly and thoroughly controlled all forms of uterine hemorrhage, including that from cancer of the womb. These observations have been confirmed by Besson, of Chambéry, Girola and Cossu, of Turin, Gaston, of Columbia, S. C.,[8] Dr. Graily Hewitt,[9] and many others. To these we may add a remarkable case of uterine cancer in which the patient was reduced to complete anæmia and exhaustion by the constant loss of blood; but ergot arrested the flow, and, with iron, produced a suspension of the active symptoms for several months. MM. Trousseau and Maisonneuve (in 1832) published twelve cases, nine of which were simple, two complicated with abortion, and one with cancer of the womb, in all of which ergot completely arrested the hemorrhage;[10] and subsequently, the former of these writers presented a larger series of observations, all tending to the same result.[11] He states that the duration of the disease does not lessen the efficacy of the medicine, a few hours sometimes sufficing to put a stop to a loss of a month or six weeks' duration. Sometimes a pale colorless flow takes the place of the bloody discharge. The dose must be varied in different cases, and sometimes carried to the same extent as during labor, but generally one-half of this quantity will suffice. Its in-

[1] Lond. Med. Gaz., xiv. 660.
[2] Am. Journ. of Med. Sci., i. 260.
[3] Ibid., ii. 89; and iii. 362.
[4] Med. Essays, ii. 295.
[5] Med. and Phys. Journ., vi. 379.
[6] Lond. Med. Gaz., xiii. 361.
[7] Edinb. Month. Journ., Feb. 1842, p. 208.
[8] Charleston Journ., xii. 459.
[9] Lancet, Dec. 1862, p. 646.
[10] Bull. de Thérap., iv. 69.
[11] Thérapeutique, 3ème éd., i. 814.

fluence is often, although not uniformly, demonstrated by the supervention of periodical uterine pains, and, when these occur, the flow will generally abate.

Besides the uterine, all other forms of *hemorrhage* are said to have been successfully treated by ergot. Sparjani, Cabini, and Negri, more particularly, vaunted its efficacy in *hæmatemesis*, *epistaxis*, and *hæmoptysis*, and Ross in *purpura hæmorrhagica*. Mr. Neate reported a case of copious gastric hemorrhage which apparently resulted from the suppression of perspiration, and was arrested by ergot after the failure of diluted sulphuric acid, muriated tincture of iron, and oil of turpentine.[1] In a case of *hæmatemesis* from gastric ulcer, Mr. Stewart, after the failure of various appropriate internal remedies, resorted to the hypodermic injection of three grains of ergotin, after which no more blood was discharged.[2] In *hæmoptysis*, which is so often alarming and intractable, ergot appears to be one of the most efficient remedies. Attention was first publicly called to it by Dr. Dobell, who learned its utility from a gentleman, who, while a medical student, had by its means arrested profuse bleeding from the lungs in his own person. According to Dr. Dobell, it is prudent to associate it with other medicines which conspire in different manners towards the same end of arresting hemorrhage, thus: ℞.—Ext. ergotæ, fl. ʒij; tinct. digitalis, fʒij; acid. gallici, ʒj; magnesiæ sulphat. ʒvj; infus. rosæ comp. ad f℥viij.—M. S.—A sixth part every two hours until the hemorrhage ceases.[3] Dr. C. J. B. Williams has said of ergot in this affection: "our experience of it has been most satisfactory, we have often tried it when other styptics have failed, and with prompt and decided effects; the dose should be at least a fluidrachm of the fluid extract."[4] The vomiting in hæmatemesis naturally suggested as a more efficient mode of employing ergot the hypodermic injection of ergotin. The first case we are acquainted with of its use in this manner occurred to Drasche, who arrested hæmoptysis in two cases by the hypodermic injection of two grains of "extract of ergot" in twelve grains of distilled water. The hemorrhage was arrested almost instantaneously.[5] A case was reported in the Edinburgh Medical Journal[6] as follows: "A patient who bled to thirty-six ounces from the lungs, had his hemorrhage completely checked within three minutes by the subcutaneous injection of five grains of ergotin." Mr. Jamieson has published a case in which the cessation of the bleeding was equally prompt under the same treatment;[7] and no less than eight cases are recorded by Dr. Ritchie in which this method was equally prompt and efficient.[8] In a case, under our care, of apparently vicarious hæmoptysis in a young lady without phthisical predisposition, this medicine on several occasions appeared to arrest the discharge, when other styptics given by the stomach,

[1] Lancet, Aug. 1854, p. 101.
[2] Edinburgh Journ., xvii. 511.
[3] Brit. Med. Jour. June 27, 1868.
[4] Pulmonary Consumption (1871), p. 368.
[5] Am. Journ. of Med. Sci., Jan. 1870, p. 254.
[6] Vol. xvi. p. 91.
[7] Brit. Med. Journ., June 1871, p. 587.
[8] Practitioner, vii. 321.

as well as inhaled, failed to produce any diminution of the loss. Mr. Wright found the *oil* of ergot an efficient hæmostatic in bleeding from the gums and from leech-bites; and both Arnal and Bonjean used *ergotin* successfully in every form of spontaneous hemorrhage. The experiments of Wright, Bonjean, and others, upon sheep and other quadrupeds by which they professed to demonstrate the hæmostatic properties of this preparation, are quite inconclusive; for, as Velpeau pointed out, and as the Philadelphia committee on the so-called Brocchieri water demonstrated, the natural plasticity of the blood in these animals is so great that wounds even of large arteries seldom destroy them. To a great extent, also, hemorrhage in man will cease under the combined effects of rest and slight compression when arterial trunks are wounded, so that there is no longer any doubt that, so far as hemorrhage of this sort is concerned, ergot and its preparations are useless.

Leucorrhœa, probably of the uterine form, was successfully treated with ergot by Marshall Hall in the example already alluded to. Eight very interesting cases of the affection were cured by Bazzoni,[1] and seven by Negri;[2] Fife also cured by its means several distressing cases where the strongest astringent injections had been employed without any effect, or with that of exciting inflammatory action.[3]

In *amenorrhœa* ergot is said by Ackerly to have been used successfully by Dr. Beckman, of New York, in 1809;[4] and some other cases are quoted by Neal, Wright, and Davies. According to Dieu[5] it has succeeded with many physicians in restoring the flow of the menses in young girls after their suppression for several months, and when ferruginous preparations had failed of their effect; and Neligan states that in several cases of chlorotic amenorrhœa he employed the infusion with the most beneficial results.[6]

"*Engorgement of the Uterus.*"—Arnal has published a number of cases of this affection as having been cured by ergot.

Uterine Hydatids.—Dr. Dewees first proposed the use of ergot to procure the expulsion of hydatids when the uterus will not readily admit the hand, or when its contractions are too feeble or are insufficient to produce their extrusion. This method was employed successfully by Dr. Macgill, of Hagerstown, Md. The uterus threw off a mass of hydatids as large as a child's head at birth, and the woman recovered without accident.[7]

Uterine Tumors.—Dr. Dewees suggested that ergot might be useful in cases of polypi, to force them beyond the neck of the uterus for the purpose of applying a ligature, or with a view to their excision;[8] and Dr. Davies appears to have been the first (1825) to carry out this recommendation. This treatment possesses the

[1] Archives Gén., xvii. 410. [2] Lond. Med. Gaz., xiii. 369.
[3] Edinb. Month. Journ., Feb. 1842, p. 209.
[4] Med. Repository, xii. 346. [5] Matière Méd., ii. 714.
[6] Medicines, their Uses. etc., 4th ed., p. 215.
[7] Diseases of Females, 3d ed., p. 302. [8] System of Midwifery, 6th ed., p. 690.

advantage of controlling the uterine hemorrhage even before it provokes the expulsion of the tumor. In 1828 Dr. McFarlane had a successful case, and in 1841 Dr. Somerville, of Edinburgh, a similar one.[1] Two very interesting instances of its success were published by Mr. Moyle,[2] one by Dr. Parr, of Newcastle-upon-Tyne,[3] and another by Duclos.[4]

Negri reports several examples of *gonorrhœa*, or rather of *gleet*, in the female cured by ergot; but it was of no service in males or during the acute stage of the disease.[5] Lallemand derived advantage from it in *seminal emissions*, and Sacchero affirms that it is "constantly curative" in this affection. Dr. C. L. Mitchell, of Brooklyn, N. Y., found it productive of the most prompt and striking effects in several cases of this distressing disorder, in some of which other remedies had proved unavailing.[6]

Langenbeck, and also Albanese,[7] have reported cases of *aneurism* cured or materially benefited by the hypodermic injection of ergotin. But Prof. Eiselt employed it in a case of aortic aneurism, and one of the innominata without advantage. On the contrary, in the first case it produced gangrene of the skin near the tumor.

Paralysis.—In 1831 Barbier reported two cases of *paraplegia* in a male and a female. Both were unable to walk, and suffered from dyspnœa and *retention of the urine.* Under the use of this medicine both experienced spasmodic movements of the legs, and the urine was discharged by jets. In the man, also, the penis recovered its erectile power, and complete recovery followed. The woman, however, ultimately died. Barbier ascribes the sensible effects of the medicine to an action upon the spinal marrow, and doubtless such is the most probable explanation of its influence in these cases and in those still to be mentioned, as well as in parturition.[8] Numerous other examples of the same result might be mentioned. Arnal relates the case of a woman affected with engorgement of the uterus and sympathetic incontinence of urine who was cured of the latter infirmity by this medicine,[9] and Monneret two cases of paralytic retention of the urine cured by the same means.[10] Allier reported four cases of retention of urine in old men which arose from neglecting to void the bladder. The medicine effected a cure after producing tenesmus of the bladder and pain in the hypogastrium.[11] Steinbeck published three cases, which, however, were acute, and may have owed their improvement to rest and time;[12] Dr. Ross, in Scotland, met with a case resembling these,[13] and Dr. Houston, of Dublin, one of more decided senile paralysis.[14] Both of the latter

[1] Month. Journ. of Med. Sci., Aug. 1841, p. 570.
[2] Ibid., June, 1841, p. 416.
[3] Ibid., Feb. 1842, p. 208.
[4] Bull. de Thérap., lxv. 211, where several other cases of its successful use are referred to.
[5] Lond. Med. Gaz., xiii. 390.
[6] Am. Med. Monthly, April, 1861.
[7] Practitioner, ii. 310; Prager Vierteljahrs., cviii. Anal. 33.
[8] Revue Méd., xlii. 332.
[9] De la Matrice (1843), p. 53.
[10] Compendium de Méd. Prat., vi. 305.
[11] Bulletin de l'Acad., xiii. 1132.
[12] Lancet, March, 1843, p. 838.
[13] Edinb. Med. and Surg. Journ., Jan. 1844, p. 43.
[14] BRAITHWAITE's Retrospect, No. ix. p. 63.

were cured by ergot in from two to four weeks. Dr. Bernard, of the same city, reported an example of this form of paralysis of the bladder cured by ergot.[1] Dr. Hargrave has given the history of a girl who seems to have had hysterical paralysis of the bladder which continued for nearly six years. Five grain doses of ergot repeated twice a day restored the function of the organ in a few days.[2] Saucerotte published a very remarkable case of this condition connected with general paralysis produced by exposure to wet and cold, which was cured by ergot after a long and fruitless trial of other remedies.[3] Aller has demonstrated, by a series of cases very minutely recorded and analyzed, that ergot (in doses of from ten to twenty or thirty grains three times a day) is competent to cure retention of urine produced by simple distension of the bladder to an immoderate degree, and even that which is owing to apoplectic disease. Still more is it competent to cure those cases of vesical paralysis which are accompanied with a more or less general paralysis of the muscles of the extremities, but which are independent of organic lesions of the nervous centres.[4] Millet also claimed that no medicine is so powerful as ergot in curing nocturnal incontinence of urine, particularly when it is associated with iron. The dose of the medicine which he found efficient was also very small. The formula he employed was the following: ℞.—Finely powdered iron filings, gr. v; powdered ergot, gr. iss. Make a sugar-coated pill. Of such pills from five to ten were given morning and evening.[5] Pétrequin found ergot successful in paraplegia when other means had failed, and he observed that, like strychnia, it produced prickling and formication of the palsied limbs.[6] He gave doses of six or eight grains, and gradually increased them until forty grains a day were taken. Payan was equally successful; one of his cases was of senile paralysis, and two others, the result of concussion of the spinal marrow.[7] Girard, of Marseilles, has also published three cases of paraplegia, the credit of whose cure is plainly attributable to ergot,[8] and Saucerotte three others of the same character.[9]

We have elsewhere (Vol. I., p. 917) directed attention to the grounds upon which Dr. Brown-Séquard explains the curative power of ergot in certain cases of spinal paralysis. This eminent physiologist has shown that by its power of causing contraction in the unstriped muscular fibres of the arteries, it limits the afflux of blood to the parts upon which the medicine specifically acts, and in the present case diminishes the amount of blood in the spinal cord and its membranes. It is, therefore, in paralysis depending upon congestion of the cord that the greatest efficacy of ergot should be displayed. And, in fact, it is so in a large proportion of cases. Several of those referred to above were occasioned by exposure to

[1] Dub. Journ. of Med., Feb. 1859, p. 218.
[2] BRAITHWAITE's Retrospect, No. ix. p. 63.
[3] Bull. de Thérap., xlv. 503.
[4] Ibid., lix. 204.
[5] Ibid., lxiii. 337.
[6] Am. Journ. of Med. Sci., xxv. 205.
[7] Bull. de Thérap., xvi. 339.
[8] Ibid., xli. 199.
[9] Ibid., xiv. 503; l. 32.

cold or by traumatic causes, such as blows or falls, which might readily give rise to hyperæmia of the spinal marrow and its membranes. Many of the other cases took place in connection with disease of the bladder, hysteria, or general exhaustion. In these the spinal paralysis was probably reflex in its origin, and maintained by the prolonged vesical, uterine, or other local irritation. Even without the removal of the primary cause, it is easy to understand that an agent capable of reducing the morbid congestion of the spinal marrow would also abate the paralysis.[1]

Whooping-Cough.—In 1856, during an epidemic of whooping-cough, Dr. Grippenkerl observed that those patients who became affected with the ergotism then prevalent were cured of the first-named disease. This led him to employ ergot medicinally, when he found that it appeared to act as a cure. Later, in 1861, during an epidemic of whooping-cough, he administered the medicine in more than two hundred cases with very decided success. He usually prescribed it in decoction, so that the virtues of twenty or thirty grains should be given in the course of a day to a child from five to seven years old. He also recommended that the treatment should not be commenced until the third week of the disease and in the absence of all complications.[2]

Impaired vision, arising from an imperfect accommodation power of the eye produced by excessive fatigue of the organ in examining minute objects, has been advantageously treated with ergot by Willebrand, who prescribed it on the hypothesis that this disorder of vision was due to congestion, and that a medicine capable of exciting the contraction of the unstriped fibres of the bloodvessels must necessarily be advantageous. He is of the opinion that ergot is useful, and in the same manner, in curing exophthalmos, goitre, and chronic inflammation of the eyes; in galactorrhœa, congestions and indurations of the uterus and of the spleen, etc.[3] We are not acquainted with any confirmation of these conclusions.

Administration.—To produce contraction of the distended uterus, the *infusion* of ergot is a convenient preparation. *One hundred and twenty grains* of ergot may be infused for one hour in *nine fluidounces* of hot water, and the liquid given in *wineglassful* doses. Such, at least, is the usual rule, but it is preferable to administer *tablespoonful* doses of the infusion at intervals of five or ten minutes. It should rarely be given during labor, unless the child is near the

[1] The extended and careful experiments of Dr. C. L. Holmes (*Arch. de Physiologie*, etc., Juin, 1870), have fully confirmed the views of Dr. Brown-Séquard. His chief conclusions are as follows: "1. Ergot and its watery extract produce contraction of the muscular coat of the small arteries. 2. This contraction augments the blood pressure in the larger arterial trunks. 3. This action is exhibited even after section of the vaso-motor nerves. 4. It appears to affect also the pulmonary vessels." In this connection it is important to distinguish between the medicinal and the toxical operation of ergot; as in the case of every other remedy that acts directly upon the nervous system, small doses of it are stimulant or exalt its natural function, but excessive or poisonous doses manifest their power, first by depressing, and afterwards by suspending or annihilating that function.

[2] Edinb. Journ., ix. 561.

[3] Brit. and For. Med.-Chir. Rev., July, 1859, p. 272.

os externum. The dose of the *powder* is from *five* to *twenty* grains, repeated every fifteen minutes. To control menorrhagia, smaller doses, such as *ten grains* every hour, at first, and then at longer intervals, will suffice. The *wine* of ergot is seldom employed; the dose of the *fluid extract* is from *one* to *three fluidrachms*. Of Bonjean's *ergotin* from *one grain and a half* to *three grains* every quarter of an hour during labor, or from *five* to *ten grains* as a hæmostatic. From one to *three grains*, dissolved in glycerin and water, may be used hypodermically.

GOSSYPIUM.—COTTON.

GOSSYPII RADICIS CORTEX.—BARK OF COTTON ROOT.

Description.—Cotton is a filamentous substance separated from the seed of Gossypium herbaceum and other species of Gossypium. The cotton plant is a shrub three or four feet high, with a round, upright, pubescent stem, brown below and spotted above. The branches are spreading, with five-lobed leaves, and bearing a cup-shaped pale-yellow flower, consisting of five petals united at their base. The capsule is three-celled, containing about three seeds in each cell surrounded by the cotton to which they are attached. The root is annual, tapering, and woody, with numerous fibres. It has neither taste nor smell.

EXTRACTUM GOSSYPII RADICIS FLUIDUM.—*Fluid Extract of Cotton Root.*

This preparation is made, according to the officinal formula, so as to procure by displacement sixteen fluidounces of extract from sixteen ounces of powdered cotton root.

History.—The cotton plant is a native of Asia, where it has been cultivated from the most ancient times for the manufacture of cloth. It was also in common use in America at the time of the Spanish conquest. Rumphius holds that it was worn by the patriarch Joseph, and was used in the drapery of the tabernacle. The hangings of Ahasuerus' palace were of dyed cotton.[1] In the time of Herodotus, the Asiatics wore cotton garments; it was not until much later that the Egyptians and afterwards the Arabians cultivated the plant for the sake of its wool. It was first introduced into the United States in 1786. The word cotton is derived through the Arabian, Hebrew, and Chaldee languages.

Uses.—The Tamool doctors are in the habit of prescribing a decoction of the *root* of the cotton plant in cases of *strangury* and *gravel*, from a notion that it is demulcent (*Ainslie*). In the cotton regions in the southern States, it is much employed to act upon the *uterine system*. Professional attention was first drawn to this

[1] Esther, i. 6, where the word *Karpasi*, Sanscrit, for cotton, is translated *blue*.

circumstance by Dr. Bouchelle, of Columbus, Mississippi, who claimed for it identical properties with ergot, or, rather, superior ones, for he stated that it originates, as well as intensifies, uterine contractions. According to this authority, it was habitually resorted to by the negroes for the purpose of producing abortion. He was of opinion, also, that it occasions sterility. Dr. B. used a decoction made by boiling four ounces of the inner bark of the root in a quart of water until it was reduced to a pint. Dose, a wineglassful every twenty or thirty minutes as an oxytocic.[1] These statements are corroborated by the testimony of Dr. Shaw, of Tennessee, who also claimed for the decoction just described very striking virtues in *dysmenorrhœa* and scanty menstruation, and particularly in *suppression of the menses* by cold.[2] A similar estimate of its virtues is furnished by Dr. Ready, of South Carolina.[3] The subject deserves further investigation.

Ainslie states that in Jamaica an emulsion of the seeds is given in *dysentery*, and is also supposed to be pectoral. Dutch physicians have recommended them as galactagogue, when given in decoction, or mixed with coffee, and stated that they have long been used in India for this purpose.[4] Cotton seed tea has also been reputed to possess *antiperiodic* virtues;[5] but the inherent improbability of such a virtue residing in a mucilaginous substance is not removed by any adequate testimony. The expressed oil, which is very bland, may be applied to all the medicinal purposes of almond oil.

When, or by whom, cotton was first used as a surgical dressing does not appear. Probably, because naturally, it would be so employed wherever it was cultivated. The first printed notice of it that we are acquainted with,[6] stated that it had been for a long time a popular remedy for *burns*. Dr. Anderson, of Glasgow, first employed it by wrapping the injured part in cotton-wool, after bathing it either with oil of turpentine, or lime-water liniment. This dressing was variously appreciated by different physicians,[7] at the time, and continues to be so. The general impression appears to be that the method is best adapted to superficial burns. For these it is comparatively the most soothing and the speediest cure. But even when the tissue of the skin is interested, the dressing is still an excellent one, provided that it be rightly applied. Cotton "laps," in that case, should never be used, unless first carded into very thin laminæ. Glazed cotton is preferable, separated by the middle and applied by its woolly surface to the skin. Several layers of the same may then be superposed. At the first dressing, the layer in contact with the skin should, if possible, be permitted to remain. If the discharge is copious, dressings of a different kind are to be preferred.

[1] Am. Journ. of Med. Sci., Jan. 1841, p. 275.
[2] Charleston Med. Journ., xi. 118.
[3] Trans. Amer Med. Assoc., ii. 722.
[4] RICHTER, Ausf. Arzn., i. 148.
[5] Charleston Med. Journ., v. 416; Ibid., ix. 97.
[6] Glasgow Med. Journ., May, 1828.
[7] CAZENAVE, Bull. de Thér., i. 230; TROUSSEAU, ibid., p. 247; Revue Méd., 1835; PAYAN, ibid., 1845.

Raw cotton is an excellent dressing for *blisters*, *excoriations*, *erysipelas*, *eczema*, and other superficial inflammations. It is far inferior to linen, or even cotton lint, as a *hæmostatic*, and as a dressing for *wounds*, on account of the difficulty with which it absorbs moisture in the first instance, and its want of firmness when once it has been wetted.

RUBIA TINCTORUM.—*Madder.*

Of non-officinal substances which have been reputed to exert a peculiarly powerful action in restoring suppressed menses, this one is deserving of mention. Tournefort said of it that "it strongly provokes the courses." Francis Home pronounced it, after repeated trials, to be the strongest and safest emmenagogue with which he was acquainted, and he reports nineteen cases of *amenorrhœa*, of which fourteen were cured by its use. Its sensible effects were scarcely evident. It was administered by him at first in doses of *half a drachm* of the *powder* four times a day, and the quantity was gradually increased to a drachm at each dose.[1] Other writers have also attested its efficacy, among whom may be mentioned Osiander, G. A. Richter, and Jahn.

SABINA.	Vid.	*Irritants.*
JUNIPERUS VIRGINIANA.	"	"
CANTHARIS.	"	"
SODII BORAS.	"	"
FERRUM.	"	*Specific Tonics.*
MILLEFOLIUM.	"	*Stimulant Tonics.*
RUTA.	"	"
TANACETUM.	"	*Anthelmintics.*
GUAIACUM.	"	*Diaphoretics.*
ALOES.	"	*Cathartics.*
HELLEBORUS NIGER.	"	"

ANTHELMINTICS.

ANTHELMINTICS are medicines capable of destroying or expelling worms which inhabit the intestinal canal. They have little, if any, effect upon *oxyures vermiculares*, which excite symptoms in the rectum alone, but they are chiefly used for the removal of *tæniæ* and *ascarides lumbricoides*.

Worm remedies may be thus divided, according to their mode of action:—

1. Those which are merely irritant, to which class belong all drastic, and especially resinous, cathartics, cowhage, and tin. These substances, by their violent action upon the bowel, increase its peris-

[1] Clinical Experiments, p. 442.

taltic movements, and thus tend to force the parasite to let go its hold upon the intestine; or they disperse the dense mucus in which it lies imbedded, and expel it from the bowels. Cowhage and powdered tin, administered to dogs, which afterwards were killed, had evidently produced a powerful irritation of the intestinal mucous membrane, and even points of bloody extravasation were found upon it. (*Kuchenmeister.*)

2. Medicines which exert an irritant action upon the stomach and bowels, occasioning more or less vomiting, diarrhœa, and colic. These are male fern, kousso, kameela, and saoria, the three first of them being among the most certain remedies for tapeworm.

3. Medicines which, besides producing more or less derangement of the stomach, act upon the nervous centres. These include American and European wormseed, pomegranate, wormwood, pinkroot, azedarach, and oil of turpentine. The nervous symptoms produced by them are numerous, but, in some instances, consist only of headache, giddiness, confusion of ideas, and weakness of the limbs, and in others of disordered vision, strabismus, dilatation of the pupils, drowsiness, stertor, spasms, or convulsions.

There is only one anthelmintic medicine which is efficient in the treatment of tapeworm, and which, at the same time, gives rise neither to vomiting, purging, colic, or nervous symptoms. This is pumpkin-seed.

The efficacy of vermifuges bears no relation whatever to their sensible properties. Tænia is the most difficult to remove of intestinal worms, and it might be expected that the most powerful agents of the present class, those of which the action upon the economy is most decided, would be the most efficient in removing it; but such is not the case. For if oil of turpentine and pomegranate, which occasion marked disturbance of the nervous system, are successful as tænifuges, kameela, kousso, and male fern, which produce no such effects, but act only on the alimentary canal, are quite equal to them in efficacy; and pumpkin-seeds, which give rise to no sensible phenomena at all, are scarcely inferior to either. On the other hand, santonicum and its preparations, chenopodium, wormwood, spigelia, and calomel, which are the most successful remedies for round worms, have little or no effect upon the tapeworm.

In regard to the comparative value of the different tænicide medicines there is not a very great unanimity of opinion, although the weight of evidence is in favor of the oil of male fern. Dr. Peacock gives the preference to it above all other remedies, and ranks kameela next to it in virtue.[1] According to Dr. Ramskill, the alcoholic preparations of kameela are more uniformly effective than oil of male fern or than spirit of turpentine, and infinitely less agreeable than either.[2] Mr. Leared would set down the relative merits of the remedies as follows: Kameela is decidedly superior to kousso, which is a less certain vermicide, and is productive

[1] Times and Gaz., Nov. 1858, p. 472. [2] Lancet, May, 1858, p. 476.

of great disturbance of the stomach, and other unpleasant effects. But he does not positively decide on the superiority of the former medicine to pomegranate bark, spirit of turpentine, and the extract of male fern.[1] Mr. Adams, on the other hand, concludes that kameela is not superior to any of these remedies;[2] and Kuchenmeister, supported by a large and well weighed experience, concludes that male fern, and especially its ethereal extract, is most efficient for the expulsion of *bothriocephali*, and the latter preparation, with the aqueous extract of pomegranate bark, is thé most certain cure for *tænia solium*.[3]

It is probable that all medicines of the anthelmintic class may be considered as either *vermifuge* or *vermicide*, or both at once. As mere vermifuges, drastic purgatives hold the first rank; they tend to expel the parasites without necessarily destroying them, and hence they are of comparatively little efficacy in the treatment of tænia solium, whose hold upon the bowel, at least by its essential organ, the head, is much more firm than that of other intestinal parasites. Tin and cowhage possess an analogous action, but are more potent in destroying the bodies of the worms, and are also more successful than drastics, especially in the treatment of tænia, which are more delicately constituted, and, therefore, more susceptible of mechanical injury. All other anthelmintics are probably in a greater or less degree vermicide and their relative efficacy can be determined only by experience. The best ascertained elements for solving this still unsettled question have been set forth in the preceding paragraphs. It is often of capital importance, however, that the two kinds of worm medicine should be conjoined in the treatment; and that, after a vermicide agent has been duly administered, the weakened or dead worms should be acted upon by a drastic or other purgative medicine, in order to expel them from the bowel.

MUCUNA.—Cowhage.

Description.—"The bristles of the pods of *Mucuna pruriens*." These bristles, setæ, or spiculæ form a hairy down upon the pods. They are delicate, sharp, stiff, brittle, and shining. The plant is a native of the West Indies, but a very similar one called *Mucuna prurita*, is obtained from the East Indies. The former is a perennial climbing plant, bearing clusters of red or purplish flowers, which are succeeded by a coriaceous pod shaped like an *f*, and studded all over with bristly hairs which the touch readily removes.

History.—The anthelmintic virtues of cowhage were first made known in Europe by Chamberlain, in 1784. Browne, in his *Natural History of Jamaica*, states that a syrup prepared with it is used in that island as an anthelmintic, and Brancroft says that it is em-

[1] Times and Gaz., Jan. 1859, p. 57. [2] Ibid., p. 59.
[3] On Animal and Vegetable Parasites of the Human Body (Syd. Soc. ed.), i. 176.

ployed by the negroes of Guiana for the same purpose. In the East Indies its employment as a vermifuge was introduced by the English practitioners, but the Tamool doctors had long ago prescribed an infusion of the root of the plant sweetened with honey, as a remedy for cholera morbus.[1]

Action.—When applied to the skin, the spiculæ adhere and cause a prickling and intolerable itching, which lasts for a considerable time. Dr. Bigelow states,[2] that when thus applied and retained in place by means of lint and adhesive plaster, they excite redness on the second day, and afterward papules, which increase in size for a week, and terminate in pustules and scabs. But when thoroughly moistened before being applied, the irritation is very slight indeed. Dr. Bigelow first noticed the curious fact that when the spiculæ are applied to the interior of the mouth, they excite none of the peculiar effects just described. Thus we have explained the comparative innocuousness of the medicine when taken medicinally. Even in large doses its effects are slight. Chamberlain states that his child of five years old swallowed by stealth three or four ounces of syrup filled with cowhage, but no inconvenience resulted beyond a diarrhœa, "which did more good than harm." To relieve the itching of the skin caused by this substance, the spiculæ may sometimes be removed by means of a mixture of plaster of Paris and water allowed to harden upon the part. When it is removed, it carries the spiculæ with it. This method would not be applicable to hairy portions of the skin. Frictions with a mixture of oil and ashes have also been recommended, and rubbing the part with the pile of a fur hat.

Uses.—*As a vermifuge*, there is no doubt that the irritant properties of cowhage led to its being originally employed. It is generally supposed to act mechanically upon intestinal worms, irritating and wounding them and obliging them to yield to the peristaltic action of the intestine.[3] This was Chamberlain's view and also Bancroft's. The latter states that he found no advantage from using either the tincture or the decoction, but that the spiculæ were efficient when mixed with syrup or honey. Dr. Bigelow, however, is disposed to believe that the medicine is quite inoperative without the purgatives which are always given in connection with it; an opinion which there is some reason to believe is correct. The materia medica furnishes so many other anthelmintics of decided power, that one of such doubtful efficacy as this might well be dispensed with.

Cowhage has been used *externally* by Graefe, in the treatment of *paralysis*. He applied a layer of it upon the affected limb, covering it with blotting paper, supported by adhesive plaster. Intense

[1] AINSLIE, Mat. Ind., i. 92.

[2] Essays, p. 154.

[3] KUCHENMEISTER gave a drachm of cowhage in syrup to a dog, who afterwards voided some fragments of tænia. Other doses were given to the amount of half an ounce. The animal was then sacrificed, and a tænia in his bowels was found quite lively, but, perhaps, rather less firmly attached than usual to the mucous membrane.

itching was produced, and an eruption which, in some instances, appears to have been followed by cure. M. Blatin[1] proposed the substitution of cowhage for tartar emetic and croton oil, as a *cutaneous irritant*. He directed an ointment prepared with seven or eight grains of the spiculæ to an ounce of lard, to be rubbed into the skin for ten or fifteen minutes. An eruption of flat papulæ is shortly produced.

Administration.—Internally, the setæ of cowhage are given in the form of an *electuary* made with honey or molasses. *One or more teaspoonfuls* should be taken, fasting, for several successive days, after which a purge of calomel and jalap should be prescribed.

STANNI PULVIS.—Powder of Tin.

Preparation.—Powder of tin is prepared by stirring melted tin during the process of cooling, and then separating the finer particles by means of a sieve. Care should be taken that it is free from arsenic, lead, and other impurities. This preparation is not officinal.

History.—Although tin has been known from a remote antiquity, and formed, it is said, an article of trade from England and Spain to Phœnicia as long ago as a thousand years before Christ, it doos not seem to have been used medicinally until a comparatively recent period. According to Sprengel,[2] tin was proposed by Paracelsus as an anthelmintic, but it was more particularly introduced to professional notice in 1735, by Alston,[3] who ascribed his knowledge of it to an "empiric receipt" which some years before fell into his hands. Fourcroy also states that in some rural districts of France it is customary to use, as a vermifuge, sweetened wine that has been kept for twenty-four hours in a tin vessel.[4]

Uses.—Alston recommended powder of tin for the armed as well as the unarmed *tapeworm*, and for the *lumbricoid or round worm*. His mode of prescribing it was imitated from the nostrum already alluded to, and may be described as follows: The patient first of all was to be purged with senna and manna, and on the following day to take an ounce of tin in four ounces of molasses, the third, and also the fourth day half of this quantity was given. On the fifth day the purgative infusion was repeated. The result is described as having been almost uniformly successful. It may, perhaps, be suspected that such quantities of an irritant substance might injure the bowel, and, indeed, cases are recorded of bloody vomiting apparently produced by it. In one, also, fatal obstruction of the bowel was ascribed to its use.[5]

Later writers claim to have been successful with smaller doses.

[1] Am. Journ. of Med. Sci., July, 1853, p. 191.
[2] Histoire de la Méd., v. 516.
[3] Edinb. Med. Essays and Obs., 3d. ed., v. 77.
[4] Mérat and De Lens, Dict. de Mat. Med., iii. 158.
[5] Richter, Ausfürlich. Arzneim., iv. 555.

Thus Mead, who recommends tin filings as "very efficacious," directs one drachm of them, with an equal quantity of red coral, to be reduced to a fine powder and made into a bolus with conserve of wormwood. Of this preparation a drachm twice a day was the dose.[1] Brera says that in cases of old, large, armed tæniæ, tin filings regularly administered produce the effect promptly and certainly, even when the preparations of male fern are ineffectual.[2] Mayor, of Geneva, assures us that tin is one of the surest remedies for these parasites. He directs a scruple at a dose, mixed with honey; but states that an ounce may be given if necessary.[3] Other successful cases are reported by Fordyce, Pallas, Monroe, Rudolphi, Bremser, Bloch, etc. Sometimes an amalgam of tin and mercury has been used. This was done by Spilman, who also added carbonate of lime and magnesia, and made of the whole an electuary with conserve of wormwood.

These are sufficient proofs of the efficacy of tin as a remedy for worms. Its mode of action is in dispute. It is generally supposed to act by its physical or mechanical properties, subjecting the worms to a rude attrition which destroys them. On the other hand, the juices of the bowels are supposed to form with the metal salts which are poisonous to the parasites. The property which wine is said to acquire by contact with tin has already been alluded to, and, moreover, Callisen, Geoffroy, and Albert assert that some of the salts of this metal are anthelmintic. It, indeed, seems probable that its chemical must be added to its mechanical action in accounting for its effects. True, they have been called in question by Kuchenmeister, in consequence of his experiments upon dogs.[4] But his results are of comparatively little weight against the multiplied and various experience of other physicians.

FILIX MAS.—Male Fern.

Description.—"The rhizome covered with portions of the stipes of *Aspidium Filix mas.*"

This is a cryptogamic plant, of the Nat. Ord. *Filices*, which abounds in the temperate regions of the old and the new world. It is, however, doubted whether the American is identical with the European plant. Its leaves, which are annual, are bipinnate, but the root, or rhizome, is perennial. It is from six to twelve inches long, and about an inch thick in its recent state, and when enveloped by the imbricated remains of the leafstalk and numerous radical fibres. In commerce it generally occurs in fragments which are yellowish-white internally, when not deteriorated by keeping. It has a sweetish, bitter, astringent, and nauseous taste. The virtues

[1] Med. Works, p. 383.
[2] Treat. on Verminous Diseases (Am. ed.), p. 238.
[3] Dierbach, Neueste Entdeck., iii. 318.
[4] Clarus, Arzneimittellehre, p. 877.

of male fern appear to be contained chiefly in the oleoresin, which comprises both a volatile and a fixed oil, resin, tannin, filicic acid, etc. The volatile oil is stated by Bock to be in the proportion of 0.4, and the fixed oil in that of 60.0 in 1000 of the dried rhizome. One or both of these oils and filicic acid may be considered as the anthelmintic elements of the medicine.

According to Peschier, the most active portions of the plant are the immature *bourgeons*, or germs. Hence he recommended that the roots be gathered at the close of summer, because earlier than this they are too soft and milky, and later they are too ligneous. Christison, however, states that he found an extract prepared from roots gathered in February perfectly successful.

OLEORESINA FILICIS.—*Oleoresin of Fern.*

It is prepared by exhausting powdered male fern with ether, and evaporating the menstruum. "It is a thick, dark liquid, with the odor of fern, and a nauseous, bitter, somewhat acrid taste."

History.—Pliny describes two species of fern, of which one is the male. He says that these ferns destroy intestinal worms, tæniæ when mixed with honey, and other sorts when given in wine. They are more sure of their effects, he adds, when associated with scammony. This author states that they are apt to induce barrenness, and also abortion in pregnant females.[1] The same account is given by Dioscorides,[2] Theophrastus, Galen,[3] Paulus Ægineta,[4] and by the Arabian writers,[5] who also recommended male fern for bruises and rheumatic pains. In the sixteenth century Gérarde and Valerius Cordus, and in the seventeenth century Simon Paulus and Sennertus referred to its vermifuge properties; and at the close of the eighteenth century they were more particularly described by Wendt.[6] Somewhat earlier it had been recommended for the cure of tænia by Andry,[7] who, however, concealed his method of preparing it. Subsequently it formed an ingredient of several nostrums which enjoyed great repute for their vermifuge properties. Such was the specific of Madame Nuffer, the widow of a Swiss military surgeon, who received eighteen thousand livres for the publication of its composition; the Herrenschandt remedy, that also of the Berlin apothecary, Matthieu, purchased by the Prussian government at the price of a pension and a title, and still another receipt, which was bought by the Medical College of Wurtemburg.[8] In all of these cases drastric purgatives were given, either along with or after the preparation of fern.

Uses.—Male fern and its preparations are almost exclusively used for the cure of *tapeworm*. Bremser says that it is an approved remedy for *tænia lata* (bothriocephalus) or unarmed tænia, but is by no means equally so for *tænia solium*, or armed tænia,[9] and other

[1] Hist. Nat., lib. xxvii. sect. lv.
[2] Lib. iv. cap. clxxvii. et seq.
[3] MATTHIOLUS, Comment.
[4] ADAM'S Comment., iii. 312.
[5] EBN BAITHAR, ed. Sontheimer, ii. 9.
[6] MURRAY, App. Med., v. 456.
[7] Genération des Vers, ii. 531.
[8] STRUMPF, Handbuch, i. 581.
[9] Lebende Würmer im lebenden Menschen, p. 154.

physicians have expressed the same opinion.[1] It is true that it was found most successful in Russia, France, and Switzerland, where the unarmed tænia prevails; but, as Brera himself related, the armed tænia, when young, will not always resist the medicine. Subsequent observations have gone farther, and shown, particularly as regards the extract of male fern, that it is capable of removing both species, although the armed tænia may somewhat more obstinately resist its influence.

So much stress is laid upon systematic administration of male fern by all who have used it most extensively that we shall describe several of the most approved methods. Wawruch treated *two hundred and six* cases, nearly all of tænia solium, according to the following plan. *Preparative treatment.*—During four or five days a solution was every day given containing twenty grains of sal ammoniac; the patient meanwhile taking no food but a thin broth at each meal. *Expulsive treatment.*—The night previously a simple injection was given. The following morning a bowl of thin soup without salt was eaten, followed in an hour by two ounces of castor oil in two doses. In the interval between these from half a drachm to a drachm of powdered male fern was administered in two or three doses, and an enema of milk and oil. Some time after the last dose of fern a drastic purge of calomel and gamboge was given, and under its operation the tænia was generally discharged. This method occasioned a good deal of pain and often vomiting, rendering the use of emollients and narcotics necessary.[2] The treatment pursued by Albers, of Bonn, and which proved successful in a large number of cases, was almost exactly the same as that just described, except that the ethereal extract was the preparation of fern employed.[3] Lambert preceded the administration of the fern by a diet of herring, onions, and similar crude articles.[4] Trousseau's method, which he states was very successful, is as follows: First day, absolute milk diet; second day, fifteen grains of the ethereal extract of male fern to be taken fasting and repeated every quarter of an hour until four doses are taken; third day, repetition of the extract as on the preceding day. After the last dose about two ounces of syrup of ether, and, in half an hour later, an emulsion containing three drops of croton oil.

Since the introduction of the extract of male fern there does not seem to be, as indeed Peschier distinctly pointed out,[5] any need of resorting to disgusting and violent, if not hazardous methods, such as that of Wawruch, or of Nuffer, which was still more complicated. The medicine appears to act as a poison to the animal and destroy it, whereupon its expulsion follows through the natural action of the intestine, or on the administration of a simple laxative. We can now, with our actual knowledge of its vermicide power,

[1] BRERA, Am. ed., p. 122.
[2] Arch. Gén., 4ème sér., i. 207; Brit. and For. Med. Rev., xviii. 328.
[3] Bull. de Thérap., xxv. 76.
[4] Ibid., xlii. 364.
[5] Rev. Méd., xx. 268.

say more with emphasis than even Murray did, "Sufficit scire quid efficiat etiamsi modus nos lateat."

It occurred to Peschier, that the oil (or volatile extract) which Morin had discovered in male fern might possess its anthelmintic properties, and he accordingly administered it in doses of from eight to twenty or thirty drops, followed by a mild purgative, and with such perfect success that he could in a short time reckon one hundred and fifty cases cured by its means. Ebers, of Breslau,[1] used an alcoholic extract, which, however, requires to be given in larger doses than the ethereal preparation. He claimed that it always acted mildly and with great certainty. Fouchon, of Neufchâtel, inclosed the oil in gelatin capsules, which he admisistered with success.[2] Many others have furnished equally favorable statements of this preparation. Dr. Christison reports the results of upwards of twenty cases of tænia treated by the oleo-resinous extract.[3] In every case the worm was discharged after a single dose, and usually in one mass. In some it was brought away without any laxative, and, for the most part, without pain or other uneasiness, though occasionally with griping, sickness, and even vomiting. He administered the medicine in doses of from eighteen to twenty-four grains.

For other cases in which male fern or its preparations have been successfully employed to destroy tænia, the reader is referred to the reports of M. Solon, Budd, Todd, Pollard,[4] Gairdner,[5] Bennett,[6] Corbett,[7] Crowther,[8] Gull,[9] Ogle, and Fleming.[10] Dr. Gull used the oil (oleo-resin) of male fern in fifty cases, and refers to two hundred in which it was employed successfully at Guy's Hospital. It was equally efficient in destroying both species of tænia. It was administered by him in doses of one and a half or two drachms in a mucilaginous draught, but the opinion is expressed that one drachm would be sufficient in the majority of cases. Even the latter dose is much larger than other physicians have found necessary.

Administration.—The forms and doses of the medicine have already been described. The dose of the powdered root is from *sixty to one hundred and eighty grains*; of the oleoresin from *thirty minims to two fluidrachms*, and of filicic acid about *thirty grains*. The last may be given in a bolus, and the oleo-resin in capsules.

CHENOPODIUM.—WORMSEED.

Description.—The fruit of *Chenopodium anthelminticum*. This plant, which is also known as wormseed, stinkweed, Jerusalem oak, etc., abounds in many parts of the United States, but most so in

[1] Archives Gén., xvii. 121.
[2] Edinb. Month. Journ., i. 674.
[3] Ibid., July, 1853, p. 47.
[4] BRAITHWAITE's Retrospect, Am. ed., No. xxiii. p. 122.
[5] Edinb. Month. Journ., June, 1852, p. 556.
[6] Ibid., Feb. 1855, p. 107.
[7] Dublin Quart. Journ., Feb. 1857, p. 226.
[8] Lancet, Nov. 1855, p. 322.
[9] GUY's Hospital Reports, 3d ser., vol. i.
[10] BRAITHWAITE's Retrospect (Am. ed.), xlvii. 88 and 91.

the southern States. "It grows in the vicinity of rubbish, along fences, in the streets of villages, and in open grounds about the larger towns." It has a strong, heavy, disagreeable odor, which is due to the presence of a volatile oil. This oil is most abundant in the seeds. They are about the size of a pin's head, rounded, of a light brown color, with an aromatic, but nauseous smell, and a pungent, offensive taste. When fresh, the oil has a light yellow color, but it grows darker by age.

History.—Wormseed appears to have been first used in Virginia as an anthelmintic. Dr. Wilkins, of Baltimore, writing in 1828, stated that for thirty years it had been employed in this manner.[1] It is still much used among the negroes of the South; but there, as elsewhere, it has been gradually supplanted by the essential oil.

Uses.—According to Chapman, all parts of the plant possess vermifuge properties, and Eberle says that a tablespoonful or two of the expressed juice, given two or three times a day, is occasionally employed for children. But this preparation is even more disagreeable than the oil. Eberle employed the latter with success to expel *lumbricoid worms* after the failure of other medicines. Dewees recommended it, provided there was no fever present. Dr. Condie employed it in some cases with decided advantage. Long ago Wilkins said that "in various instances where parents have erroneously supposed worms to exist, this fine stimulating oil has removed general debility, indigestion, and colic, with various other unsuspected disorders, and has restored health to the little patient." Dr. J. F. Meigs has been struck with similar qualities in the medicine, for he says,[2] "It not only produces the expulsion of the parasites when they exist, but also acts beneficially upon the forms of digestive irritation which simulate so closely the symptoms produced by worms." Dr. Monsarret, of Kibeggan, has reported the particulars of a case of *tænia* cured by this oil, and says there are many other cases in which he has used it with complete success.[3]

The oil of chenopodium has also been used in *intermittent fever*, *hysteria*, *chorea*, and other *nervous affections*.

Administration.—The *expressed juice*, when fresh, may be given in *tablespoonful* doses twice or thrice daily. A *decoction* made by boiling an ounce of the *leaves* in a pint of milk or water has also been used. The bruised or pulverized *seeds* are given in an electuary, in doses of *twenty or more grains* three times a day. It is often useful to combine carbonate of iron with this preparation. The dose of the *oil* (OLEUM CHENOPODII) is *five* or *ten drops* three times a day for a child three years old. It may be mixed with powdered sugar or in an emulsion. Whatever preparation is selected, after two or three days' use of it, a dose of castor oil should be given.

[1] COXE's Med. Museum, v. 252.
[2] Diseases of Children, 2d ed., p. 695.
[3] Med. Times, Dec. 1844, p. 140.

SANTONICA.—SANTONICA.

Description.—This medicine, which is also known as Levant wormseed, consists of the unexpanded buds of *Artemisia cina*, which grows in Persia and the adjacent countries, and of other species of Artemisia. It is said to have been introduced into European practice by the Crusaders. When rubbed, it emits a strong, peculiar, and somewhat aromatic smell, and it has a warm, bitter, and spicy taste. These properties depend, in part, upon an essential oil. It also yields a crystallizable substance called *santonin*.

SANTONINUM.—*Santonin.*

It is obtained by digesting santonica with diluted alcohol and slaked lime; the santonin is afterwards precipitated from its union with the lime by means of acetic acid.

This substance is more properly called santonic acid. It is soluble with great difficulty, being nearly insoluble in cold water, but is dissolved in two hundred and fifty parts of boiling water. It is soluble in forty-three parts of cold or in three parts of boiling alcohol, and in seventy-five parts of ether. From a pure alcoholic solution it deposits shining, transparent, flattened prisms, which grow yellow on exposure to the light.

Action. *On Animals.*—Given to rabbits in the dose of thirty grains, santonic acid caused the animals to remain very still and pass a large quantity of purplish or saffron-colored urine; they appeared to die by gradual exhaustion. Rose, who performed these experiments, also administered oil of santonica to rabbits. In one itstance an ounce was thrown into the stomach. Within five minutes the animal lay upon its side in opisthotonic spasms. The breathing was short and labored, and in eighty-five minutes death took place. Doses of from one to three drachms occasioned similar phenomena, but more slowly.[1] Von Hasselt and Reinderhoff obtained identical results from their experiments with santonic acid, and concluded that the fatal termination was owing to spasms of the respiratory muscles producing asphyxia. After death the lungs, heart, brain, and spinal marrow, with the investing membranes of these nervous centres, were found, the former organs engorged with blood, and the latter in a state of hyperæmia. Later experiments have furnished similar results.

On Man.—Rose reports the following experiment performed upon himself. One evening he took three grains of santonic acid, and, at the end of three hours, repeated the dose. At this time the blue halo of a wax taper appeared yellow. His sleep was disturbed by colic. On awaking, his skin seemed to him to have a corpse-like hue, the white bed-cover appeared yellow. The urine was of an orange color. He then took four grains more of the acid, and in the course of the forenoon eight grains more. His

[1] VIRCHOW'S Arch., xvi. 233.

mind was somewhat confused, and there was some nausea, which disappeared after a hearty meal. In the evening, when taking a walk, everything appeared yellow, and men like wandering ghosts. He felt weary also, and vision was not perfectly distinct. The urine was passed more frequently than usual, but in less than the usual quantity. It grew red on the addition of an alkali, but this color disappeared on acidulation with nitric acid. The sense of weariness continued more or less for five days. The red tint of the urine was still apparent at the expiration of six weeks. Dr. Farquharson states that five grains of santonin given to a boy of twelve occasioned profuse diuresis, and that a similar dose taken by himself decidedly increased the quantity of urine, producing also an uncontrollable desire to micturate. The urine was of a deep saffron color, staining the linen precisely as bile. It had a sp. gr. of 1.028. White objects appeared to be yellowish-green within twenty minutes after the dose was swallowed, the color increased for three hours, and then slowly faded. During the operation of the medicine a feeling of profound and unusual depression was experienced, affecting both mind and body.[1] In another case, by Mr. Page,[2] the patient passed involuntarily during sleep a large quantity of urine. An eruption of urticaria, clearly due to the ingestion of less than three grains of santonin, has been described by Dr. Sieveking.[3]

Small doses of the seeds of santonicum increase the appetite and stimulate the digestion but slightly; larger doses produce some general excitement, quickening the pulse and augmenting the warmth in impressionable persons. Still larger doses occasion gastric oppression, nausea, vomiting, colic, and diarrhœa.[4] Dr. Spencer Wells was the first to describe the phenomena above referred to, viz., that under its influence, or that of santonin, the vision becomes affected so that objects are seen as if through a yellow medium, the blue appearing green, etc.[5] If the dose is very large, the field of vision may be red.[6] Dr. Rose, of Berlin, instituted a large number of experiments by which he claims to have shown that the violet and then yellow color which covers the field of vision during the use of santonin, is due, not to any actual change in the color of the media by which the rays of light reach the retina, but to an altered perceptivity in the nervous organ of vision itself.[7] Subsequently Rose found that in all cases "yellow sight" exists, but "violet sight" in only nineteen out of thirty cases; among these there were also six cases of hallucination of smell and five of taste.[8] The experiments of Dr. D. Dyce Brown appear to prove that the cause of this yellow vision does not reside in any of the media of the eye, but either in the retina or in the brain itself.[9]

In doses of more than three grains, santonin sometimes occasions

[1] British Med. Jour., Oct. 1871, p. 466. [2] Ibid., Sept. 1871, p. 323.
[3] Ibid., Dec. 1871, p. 166. [4] MITSCHERLICH, Lehrbuch, ii. 120.
[5] CANSTATT's Jahresbericht für 1853, p. 150.
[6] Annuaire de Thérap., xix. 237. [7] VIRCHOW's Archiv, xviii. 24.
[8] Dublin Quart. Journ., Aug. 1870, p. 191.
[9] Brit. and For. Med.-Chir. Rev., April, 1871, p. 472.

nausea and vomiting, with abdominal pain, great thirst, giddiness, and profuse diarrhœa.[1] Decidedly poisonous effects sometimes arise from doses which are quite insignificant in comparison with those which some experimenters have taken without serious inconvenience. In one case it is stated that a child six months old and convalescent from smallpox took five grains of santonic acid instead of three which had been prescribed. It became amaurotic, and did not recover its sight for two months.[2] In another case two grains of this substance were taken by a healthy child of two years. In a quarter of an hour it was seized with convulsions, and within one hour it lay unconscious, with a hot head and congested face, the eyes twitching convulsively, the pupils largely dilated and insensible, the mouth foaming, the teeth clenched, the breathing stertorous, and the upper limbs occasionally jerking. On the morrow recovery was complete.[3] Spengler states that a child four years old took four grains of santonin in two doses: there followed gastric oppression, colic, vomiting, and diarrhœa with the evacuation of a large number of lumbricoid ascarides; the skin grew cold and damp, the face pallid, the eyes sunken, and they as well as the lips and ears were livid, respiration was labored, and the limbs twitched. The pupils were largely dilated, and the abdominal pains were not increased by pressure. Gradually the child recovered.[4] Symptoms of the same nature were occasioned in the case of a boy under two years of age by less than a grain and a half of santonin. It is stated that in this case the conjunctiva was yellow, and the mouth ulcerated, symptoms which were probably independent of the medicine.[5] In two cases Hoffmann witnessed such alarming cerebral symptoms after the administration of santonica, that he was obliged to apply leeches to the temples and cold compresses to the head.[6] According to Giovanni, a child six or seven years of age took six grains of santonin, soon afterwards began to pass bloody urine, and died from the continuous hemorrhage.[7] This author cites another who met with analogous cases; but it is probable that he was mistaken as to the nature of the colored urine, especially as he distinctly states that the patient had neither ischuria nor tenesmus. Lavater met with two cases of poisoning by santonin presenting symptoms like those already described; one of them ended fatally.[8] These examples are sufficient to illustrate the somewhat uncertain operation of santonica and its acid both in degree and in kind, and to suggest caution in its administration.

Uses.—Santonica possesses decided anthelmintic properties, as its title of *semen contra*, i. e., *semen contra vermes*, plainly shows. It is generally successful in destroying lumbricoid and vermicular ascarides, and, in some instances, it has procured the discharge of the tapeworm also. Santonin is even more certain in its effects.

[1] Lancet, April, 1859, p. 402.
[2] Bull. de Thérap., lviii. 519.
[3] Annuaire de Thérap., xxii. 180.
[4] Deutsche Klinik, 1840, No. 46.
[5] Bull. de Thérap., lxxxii. 78.
[6] FRANK, Magazin. der Arzneim., i. 40.
[7] Bull. de Thérap., lxxiv. 361.
[8] REIL, Chem. Pflanzenstopfe, p. 273.

Numerous reports of its efficacy have been published by Perry,[1] Bishop,[2] Garnies,[3] Smith,[4] More,[5] and others. In a case related by Bouchut of a child two years old, a single dose of two grains of santonin caused the evacuation during the day of one hundred and sixty-six lumbricoid worms; during several succeeding days the medicine was continued and brought away thirty-seven more of the parasites.[6] It has been employed with alleged advantage in subacute and chronic inflammations of the *choroid* and *retina*. Martini and Guépin have reported very favorably of its use. The latter administered it in doses of three grains twice a day, for five days consecutively. Dr. D. Dyce Brown,[7] after trying the medicine in thirty-five cases of "nervous deficiency" of the eyes, says, "no doubt was left in our minds that it possesses a great power over many cases of inflammatory and atrophic alterations of the nervous elements of the eye, and is superior, in the treatment of such, to the remedies ordinarily employed." It also seemed to possess a very decided effect upon "hyperæsthesia of the retina."

The *dose* of this medicine in powder is from *ten to sixty grains* three or four times a day. It may also be prescribed in either of the forms recommended for chenopodium. Of *santonin* from *three to six grains* may be given to an adult, or from *one to three grains* to a child, mixed with sugar, every four hours until three or four doses have been taken, when they should be followed by a dose of castor oil. Owing to the insolubility of santonin Dr. Harley has proposed a combination of it with soda in solution. Twenty grains of bicarbonate of soda are dissolved in three ounces of water and boiled; while boiling twelve grains of powdered santonin are gradually added, and the liquid reduced to three ounces. Such a preparation may be necessary for local application, especially for injection into the bladder, but judging from the rapidity and the energy of santonin as ordinarily given, it does not require for internal administration any other solvent than such as it meets in the stomach.

TANACETUM.—TANSY.

Description.—This medicine, the herb of *Tanacetum vulgare*, belongs to the secondary list of the U. S. Pharmacopœia. The flowers and seeds are also endowed with medicinial properties. Tansy is indigenous to Europe, but is cultivated in our gardens, and grows wild in the neighborhood of old settlements. It is a perennial herbaceous plant, bearing yellow flowers arranged in a dense terminal corymb. It exhales a strong, penetrating, but not unpleasant odor when fresh, and its taste is bitter and aromatic. These qualities depend mainly upon an essential oil which is most

[1] Times and Gaz., May, 1856, p. 492.
[2] Ibid., July, 1856, p. 22.
[3] Annuaire de Thérap., 1857, p. 235.
[4] Lancet, April, 1859, 349.
[5] Ibid., p. 402.
[6] Bull. de Thérap., lxxxi. 322.
[7] Loc. sup. cit.

abundant in the flowers and seeds; the latter also contain a large proportion of a bitter principle. The essential oil is of a yellowish-green color, and has, in a high degree, the odor of the plant. The virtues of the plant are imparted to water and alcohol.

Action.—According to some authors tansy, in moderate doses, acts as a gentle stimulant to the digestive organs, and when more freely given, produces some general excitement, augments the urine and perspiration, and may bring on nausea, vomiting, and diarrhœa. In overdoses the oil acts as a fatal poison, producing unconsciousness, flushed cheeks, dilated pupils, hurried, stertorous respiration, strong spasms, a full and frequent pulse, repeated convulsions, and then a failing pulse, and death.[1] Even when not fatal, it may occasion convulsions and insensibility.[2] In a case of attempted abortion by a decoction of the herb, Dr. Pendleton observed delirium, slow and laborious respiration, contracted pupils, a dusky countenance, fixed features, and cool skin. Subsequently the muscles of deglutition and all the voluntary muscles became paralyzed, and death, with gradual retardation of the heart's action, took place in twenty-six hours after the poison was taken.[3] Hence it would appear that the operation of tansy is not the same as that of its essential oil.

Uses.—Tansy was used in the middle ages, and formed one of the remedies of Hildegarde, for *amenorrhœa*.[4] Other chronic affections, particularly of the abdomen, were treated by its means. Floyer (1687) states that the juice and the seeds are given for *worms*, and that the latter are diuretic.[5] Alston presents a similar statement with more details.[6] Dubois gives the following summary of opinions in regard to its vermifuge properties.[7] Hoffmann considers enemata made with milk in which tansy has been infused, as one of the best means of destroying ascarides. Bourgeois regards an infusion or decoction of the tops as an excellent vermifuge. Geoffroy caused the evacuation of thirty-two lumbrici, by applying tansy to the abdomen. Schenckius administered tansy seeds to a child, and produced the expulsion of more than one hundred lumbrici. Dubois, himself, says that in nineteen out of thirty cases in which this medicine was exhibited as a vermifuge, more or less worms were discharged. He also relates a case of *tænia* which was cured by its use. These facts, and others which might be cited, demonstrate the possession of real anthelmintic virtues by this plant.

Of the other uses of tansy, in *hysteria*, *gout*, *rheumatism*, and *dropsy*, it is needless to say anything, as other more appropriate and powerful remedies for them are at hand. The popular use of the medicine to overcome *irregular or suppressed menstruation* arises, no doubt, from its general stimulant property, and not from its specific

[1] DALTON, Am. Journ. of Med. Sci., Jan. 1852, p. 136.
[2] CHAPIN, Boston Med. and Surg. Journ., Dec. 1857, p. 383.
[3] Am. Med. Times, ii. 177.
[4] STRUMPF, i. 578.
[5] Touchstone of Med., p. 189.
[6] Mat. Med., ii. 232.
[7] Mat. Méd. Indig., p. 387.

emmenagogue virtues. In the cases of poisoning by oil of tansy already alluded to, the medicine had been taken with the criminal purpose of producing abortion, but without avail.

Administration.—The dose of the powder of the *seeds* of tansy is from *ten to forty grains*, of the *flowers*, from *twenty to one hundred and twenty grains*. An *infusion* made by adding from half an ounce to an ounce of the seeds, or twice that quantity of the flowers, to a pint of boiling water, may be given in doses of *one or two ounces*. Of the *oil*, the dose is from *one to four drops*, or more.

GRANATI FRUCTÛS CORTEX.—Pomegranate Rind.

GRANATI RADICIS CORTEX.—Bark of Pomegranate Root.

Description.—The pomegranate tree, *Punica Granatum*, is a native of the South of Europe, Barbary, Arabia, Persia, and Japan, and is cultivated in the West Indies and the United States. It is a small tree, but in favorable situations often rises to the height of eighteen or twenty feet. The leaves are of a light-green color, pointed at either end, and about three inches long by half an inch broad in the middle. The flowers are of a beautiful red color, but have no smell. The fruit is about the size of an orange; its rind is extremely hard and tough, and of a reddish-brown color. It contains a subacid and succulent pulp, and numerous seeds.

As found in commerce, pomegranate flowers (*balaustines*) have a bitter and astringent taste. The rind of the fruit occurs in irregular fragments which are very hard and brittle, of a reddish-brown color externally, but paler within. The bark, as found in the shops, is in quills or fragments of a grayish yellow color externally, and yellow within. It is inodorous, has an astringent taste without bitterness, and, when chewed, colors the saliva yellow.

The analyses of pomegranate rind and bark have not furnished very definite results. The former would appear to contain the larger proportion of tannin, the latter of a fatty matter described by Wackenröder as "rancid fat oil." It is probably on this oil, as well as upon tannin, that the vermifuge qualities of the medicine depend.

History.—Pomegranates were among the most anciently known of fruits. They are mentioned, along with grapes and figs, among the productions of "the land of promise." Homer enumerates them among the fruits that were suspended over the head of Tantalus to tempt his appetite,[1] and Venus is fabled to have planted the first pomegranate tree. It must have been very anciently used in medicine. In the Hippocratic writings it is described chiefly as an astringent.

[1] Adams, Comment. on Paul. Æginet., i. 134.

Cato, the Censor, who flourished two hundred years B. C., is, perhaps, the earliest authority that can be cited in regard to its vermifuge properties. He prescribed an infusion made of unripe pomegranates bruised.[1] Celsus appears to be the first to allude to its power of destroying the tapeworm.[2] Dioscorides describes it as a remedy for foul ulcers, and for dysentery, leucorrhœa, prolapsus ani, and especially tænia.[3] Pliny insists upon all of these particulars, and speaks of its use for worms generally, as well as for tænia.[4] All of the Arabian authors mention its astringency. Rhazes describes it as an anthelmintic, and recommends the powdered rind of the fruit.[5] Avicenna directs the bark of the root to be taken in substance or decoction for lumbrici and ascarides. Several European writers of the middle ages renewed these statements, yet for a long time the medicine seems to have been forgotten, and was only restored to use by the English physicians in India. The first mention of it in modern writings is contained in a communication from Dr. Buchanan, of Calcutta, in 1805,[6] who gives the native formula for its use. Five years subsequently, Dr. Fleming published some cures of tænia by the pomegranate decoction in his Catalogue of Indian Medicinal Plants and Drugs, and in 1844, Dr. Burt,[7] and in 1820, Mr. Breton cited cases of its success in India.[8] The latter concluded from the writhing, and rapid death of live tæniæ plunged in a decoction of pomegranate root, that its direct action upon them was poisonous. In 1822, a Portuguese physician, Gomez, published a memoir containing fourteen cases of the cure of tænia by this substance.[9] The paper was translated in France by Mérat, and attracted general attention. The last-named author published, in 1832, a valuable monograph on the subject. Subsequently, pomegranate was received into all the Pharmacopœias, and into that of the United States in 1842.

Action.—Mérat himself took the decoction of Pomegranate prepared in the manner directed below. It produced nausea, borborygmi, some colic, occasional cramps in the calves of the legs, and three stools of a light-yellow color. The urine was rendered more abundant than usual; but within twenty-four hours all of these symptoms passed away. When given as a vermifuge it occasions the same symptoms, essentially, but sometimes there is giddiness, dimness of vision, drowsiness, faintness, numbness of the limbs, and even convulsions. The fresh bark of the root is the only portion of the plant which produces these effects, and which can be relied upon for the expulsion of tænia.

Uses.—This medicine is chiefly valuable as a remedy for *tænia.* Ainslie[10] tells us that the Mahometan physicians in India (whither it was introduced from Persia) consider it a perfect specific in cases of tapeworm. They give it in decoction prepared with two ounces

[1] Bayle, Bibl. de Thérap., i. 313.
[2] Book iv. chap. xvii.
[3] Lib. i. cap. cxxvii.
[4] Lib. xxiii. cap. lviii. and lx.
[5] Ebn Baithar, i. 502.
[6] Edinb. Med. and Surg. Journ., iii. 22.
[7] Ibid., x. 419.
[8] Med.-Chir. Trans., xi. 301.
[9] Bayle, op. cit.
[10] Mat. Indica (1862), i. 523.

of fresh bark boiled in a pint and a half of water, until three-quarters of a pint remain. Of this, when cold, a wineglassful may be drunk every half hour, until the whole is taken. The most complete account of the curative effects of the medicine are contained in the memoir of Mérat, already referred to, and which contains a summary of *one hundred and ninety-two cases* cured by the bark of the root. M. Mérat asserts that it never fails if administered according to the following rules: It ought never to be given unless the patient has actually voided some joints of the worm, and then, if possible, on the following day. The decoction ought always to be made of the fresh bark of the root and prepared as follows: Take two ounces of the bark and let it soak over night in a pint and a half of water, and then by gentle boiling reduce it to a pint; strain off the liquor, expressing the grounds, and give it lukewarm in three doses, at intervals of an hour, before the patient has broken his fast. No purgative or other treatment need precede or follow that which has been described. If the first dose is vomited, the others should still be administered, and they will generally be retained; but if all are rejected, the treatment must be renewed on a subsequent occasion.

For the purposes of an astringent medicine merely, the rind of the fruit is most frequently employed, as in the treatment of *chronic diarrhœa*, *leucorrhœa*, and *passive hemorrhages*. Its decoction may be used as an injection in open *cancer of the uterus* and *ulcerous diseases of the rectum*, accompanied with a bloody discharge. It also forms an excellent *gargle* in relaxed states of the fauces.

Administration.—The dose of the rind or flowers in *powder* is from *twenty to thirty grains*. The officinal decoction of the root (*Br. Ph.*) is prepared by boiling two ounces in two pints of water, to a pint. One-third of this quantity may be given every hour. The preparation of the bark of the fresh root, as advised by Mérat, is more efficacious.

ABSINTHIUM.—Wormwood.

Description.—Absinth (*Artemisia absinthium*) is a perennial plant, which is native in all parts of Europe, except the extreme north, and grows wild in open places. It has been naturalized in the United States. The tops and leaves are officinal. They have a hoary look, a soft silky feel, a strong aromatic odor, and a bitter and aromatic taste, qualities which are due to the presence of a green essential oil, and a bitter, resinous principle, called *absinthin*.

History.—Wormwood appears to have been very anciently and very extensively employed. In the Bible it is several times referred to as a type of bitterness. Hippocrates describes it as an emmenagogue. Pliny enumerates various cases in which its use is beneficial both internally and externally; among the former, he refers to its stomachic, carminative, tonic, emmenagogue, and anthelmintic qualities, and among the latter, he mentions its power of

healing sores.[1] Dioscorides furnishes a similar account, and the Arabian writers add but little to the catalogue of its virtues.

Action. *On Animals.*—According to Marcé's experiments upon dogs and rabbits, essence of absinth in the dose of from fifteen to forty-five grains produces dulness and insensibility, and in doses twice or thrice larger epiliptiform convulsions, involuntary stools, stertor, and frothing at the mouth.[2] Similar effects were witnessed by Magnan and Bouchereau,[3] and by Magnan.[4]

On Man.—Wormwood tends to increase the appetite and promote digestion. In small doses, it does not excite the circulation unless plethora or fever be already present. In larger quantities, it augments the general warmth of the body, and increases somewhat the activity of the pulse and of the secretions. Overdoses produce gastric pain, nausea, and vomiting. Occasionally, headache and giddiness, with dulness or confusion of ideas, have been observed after large doses, and are probably due to the essential oil which the plant contains. It gives a bitter taste to the milk and the flesh of animals that have eaten it, which proves that its bitter principle is absorbed.[5] A male adult who had taken about half an ounce of the oil was insensible and convulsed, his jaws were clenched, and he foamed at the mouth. He recovered under the use of emetics with stimulants and demulcents.[6] Cases have been observed which render it probable that the habitual use of intoxicating doses of alcoholic preparations of absinth tend to occasion epileptiform convulsions and a rapid and general degradation of the mental and physical powers.

Absinthin is a yellowish-white powder, of an offensive smell, and a penetrating and bitter taste. It is soluble in water and alcohol, acetic acid, and the alkalies, and has an acid reaction. Its effects are represented differently by Leonardi and by Righini, the former stating that in large doses it occasions faintness and insensibility, but the latter that it is a pure tonic bitter.[7] Of these statements the former is the more probable.

Uses.—As a stomachic tonic, wormwood is one of the most common and useful among those employed in Europe. The union of its stimulant and bitter principles adapts it to a large class of cases in which the appetite is feeble and the digestion impaired, independently of an inflammatory or organic change of the stomach, and whether the *dyspepsia* exists as an independent affection or in connection with constitutional derangement. It has been highly recommended in *scrofula*, *chlorosis*, *jaundice*, *dropsy*, *chronic bowel complaints*, etc., in all of which it may doubtless promote the due assimilation of the food. In *flatulent dyspepsia*, an alcoholic tincture or cordial of absinth is much employed in Europe. Formerly, absinth was commonly and successfully prescribed for the cure of mild cases of *intermittent fever*, but chiefly as a domestic remedy. Like other tonics, it has been recommended in *epilepsy*.

[1] Hist. Nat., xxvii. 28.
[2] Annuaire de Thérap., 1865, p. 146.
[3] Bull. de Thérap., lxxii. 139.
[4] Ibid., lxxx. 373.
[5] MITSCHERLICH, Lehrbuch, ii. 118.
[6] Lancet, Dec. 1862, p. 619.
[7] REIL, op. cit., p. 21.

The *anthelmintic* virtues of absinth are not very remarkable. Its long-continued use will doubtless cause the expulsion of lumbrici and ascarides, and prevent their reproduction, by giving tone to the digestive organs. M. Cazin recommends a preparation made by digesting equal parts of wormwood and garlic in a bottle of white wine, of which the dose is from one to three ounces every morning.

Externally the decoction of wormwood has been used as a dressing for *indolent* and other *unhealthy ulcers*.

Administration.—In *substance*, the dose of wormwood is from *twenty to forty grains*. An *infusion*, made by macerating one ounce in a pint of boiling water, may be given in doses of *one or two fluid-ounces*. The dose of the essential *oil* is from *four to eight drops* in a sweetened mixture with ether or sweet spirits of nitre.

BRAYERA.—Koosso.

Description.—This vermifuge, which is now officinal, consists of the flowers and unripe fruit of *Brayera anthelmintica*, a native tree of Abyssinia. On analysis, they are found to contain, as the apparently active components, a fatty oil, an acrid resin, tannin, and a principle called koossine. As procured by Pavesi, and afterwards by Vée, it is represented to be yellow, bitter, insoluble in alcohol and in alkalies, and uncrystallizable. St. Martin had previously described it[1] as forming white, acicular crystals, soluble in alcohol, ether, and acids.

History.—The first mention of koosso appears to be that made by Godingus (1615), who states that the Abyssinians employed it annually to purge themselves of worms,[2] which appear to be singularly prevalent among these people. Subsequently (1790) the celebrated traveller, Bruce, confirmed this statement, and furnished a drawing of the tree from which the medicine is derived. In 1823 Brayer, a French physician, on his return to France from Constantinople, where he had resided for several years, brought with him some flowers of koosso, whose tænifuge powers he had tested.[3] Specimens of the plant and accounts of its use were afterwards sent from Abyssinia by Schimpfer, and it was employed with various success by Plieninger, Kurr, and Riecke.[4] In 1840 a memoir treating in part of this plant was read before the Parisian Academy of Medicine by Aubert, who had experienced its benefits in his own person during a residence in Abyssinia. Of its use in Africa, Mr. Vaughan, a surgeon of the East India Company stationed at Aden, on the Red Sea, says: "In Southern Arabia, on the seacoast, and along the shores of the Red Sea it is well known and considered a most valuable medicine. In Northern and Southern Abyssinia it

[1] Bull. de Thérap., xxiv. 285.
[2] PEREIRA, Mat. Med. (3d Amer. ed.), ii. 804.
[3] Bullet. de l'Acad., vi. 492.
[4] RIECKE, Neue Arzneim., p. 101.

is universally used about once a month, the trees being numerous, and the medicine costing hardly anything. . . . . Bruce mentions that no Abyssinian will travel without it. The few Abyssinians who visit the port of Aden invariably bring with them a supply."[1]

In 1847 Mérat reported five cases of its efficacy observed by himself, Chomel, and Guéneau,[2] and others were published by Sandras.[3] In a paper by Dr. Budd, in 1850,[4] it is stated that nine doses of the medicine had been given by him, and not one of them failed to kill and expel the worm. In several the systematic use of other remedies had failed. Other successful examples of its use are reported by Inglis,[5] Oliari and Masserotti,[6] Edmonds,[7] and Dane.[8] Dr. Dane states that he treated fifteen cases, in all of which the worm, with the head, was removed. Richardson, Mitchell, Neville, and others, in Ireland, also published examples of its success.[9] Dr. Barclay, it is true,[10] has referred to several instances in which only partial success was obtained. Some German writers, as Albers and Meyer-Ahrens, reported similar results, which must be ascribed to the bad quality of the drug employed, or to its imperfect administration.

Mr. Johnson, a traveller in Abyssinia, is quoted by Pereira as stating that the operation of koosso is dreadfully severe, that it produces miscarriages often fatal to the mother, and even death when larger doses are taken. He adds that even in its native country it is but barely tolerated. Kuchenmeister states that it readily produces sickness and violent pains in the intestines, and that he generally was unsuccessful in its use. These statements cannot be fully accepted, for they are directly at variance with the ordinary results of European observation. Thus, Mérat says that in the cases reported by him it produced no colic nor other annoyance, nor restrained the patients from their ordinary occupations. Sandras observes that its taste sometimes excites a slight degree of nausea, and that, in the course of an hour or two, several stools succeed one another, generally without colic, and containing fragments of the worm. The first stools contain fæcal matter, and the last is composed of the infusion as it was swallowed. The worm is nearly always discharged dead.

Administration.—Aubert thus describes the native mode of employing the medicine. An infusion is made with water or beer, or the flowers are mixed with honey, to the amount of from four to six drachms. This dose is taken in the morning, fasting, and no other food is eaten during the day. Generally the worm is discharged in the course of twenty-four hours without purging. On the morrow the person resumes his usual pursuits, and, as the head of the worm is generally retained, it grows anew, and in the course

[1] Lancet, Sept. 1850, p. 305.
[2] Bull. de l'Acad. de Méd., xii. 690.
[3] Annuaire de Thérap., 1847, p. 256.
[4] Lancet, June 29, p. 773.
[5] Med. Times, July, 1850, p. 83.
[6] RANKING's Abstract, 1852 (Am. ed.), p. 98.
[7] Times and Gaz., June, 1855, p. 541.
[8] Ibid., p. 608.
[9] Dublin Med. Press, Feb. and March, 1851.
[10] Med. Times, Oct. 1851, p. 408.

of a few months requires a repetition of the dose, which, however, is not disagreeable in smell or taste, and does not cause either pain or colic.[1] The same account is furnished by Engleman. In Europe the usual method is to give *half an ounce* of the powdered flowers mixed with *water* at a single dose. An *infusion* (Br. Ph.) made with one hundred and ten grains of the drug in four fluidounces of boiling water, is administered, when cold, without previous straining, so that the infused powder shall be exhibited along with the fluid portion. It is proper, as in the case of other vermifuges, for the patient to diet on the day before its administration.

SPIGELIA.—Spigelia.

Description.—The root of *Spigelia Marilandica.* This plant, popularly known as pinkroot, is a native of the southern and southwestern States of the Union. It grows in dry, rich soils on the borders of woods. It has a quadrangular, smooth, and purplish stem; the leaves are opposite, sessile, ovate, glabrous in the centre and pubescent on the edges. The flowers form a terminal raceme. The corolla is funnel-shaped, red externally and orange within. The root consists of numerous slender, blackish fibres arising from a thick and knotty rhizome. Its odor is faint but peculiar, and its taste is sweetish and somewhat bitter. According to Feneuille, the root contains a fixed and a volatile oil, some resin, and a peculiar bitter substance, gallic acid, etc. It is said to lose its active properties by keeping.

Other species of spigelia possess anthelmintic powers, and *S. anthelmia* in even a greater degree than the officinal plant. This species grows in Jamaica, and is regarded as an infallible remedy for worms by the inhabitants. It displays very decided narcotic and stimulant properties.[2]

The officinal preparations of spigelia are the following:—

Extractum Spigeliæ Fluidum.—*Fluid Extract of Spigelia.*

Sixteen troyounces of spigelia are treated according to the officinal formula for the preparation of fluid extracts. *Dose*, for an adult one or two fluidrachms.

Extractum Spigeliæ et Sennæ Fluidum.—*Fluid Extract of Spigelia and Senna.*

This extract is prepared by mixing ten fluidounces of fluid extract of spigelia with six fluidounces of fluid extract of senna, and adding carbonate of potassa, and oils of anise and caraway. *Dose*, for an adult, half a fluidounce, for a child, a fluidrachm.

Infusum Sipgeliæ.—*Infusion of Spigelia.*

Macerate half a troyounce of spigelia in a pint of boiling water for two hours in a covered vessel, and strain. *Dose*, for an adult,

[1] Loc. sup. cit.
[2] Browne, Med. Museum, 2d ed., 1781, i. 221.

from four to eight fluidounces; for a child of three or four years old, from half a fluidounce to a fluidounce.

History.—Spigelia appears to have been used medicinally by the aborigines, from whom Lining derived a knowledge of its virtues in 1754. It was also early recommended by Garden and Chalmers, of South Carolina.

Action.—Some authors ascribed purgative powers to this medicine.[1] Barton, on the contrary, recommended that its action should be quickened by the addition of a purgative, and Chapman advises the same combination, but with a view of counteracting its narcotic operation. Wright first pointed out its narcotic properties, and Barton attributed cases of death to its employment. Two fatal cases were published by Chalmers. Chapman attributed its efficacy as a vermifuge to its narcotic influence on the intestinal worms. Dr. Ives adopted a similar view, and believed that it first stupefies and then expels these entozoa. He further compared the action of the fresh root to that of digitalis and stramonium. Like the former, it quiets general nervous irritation, and, like the latter, it causes dilatation of the pupils and a sort of mental derangement with alternate fits of laughing and crying, and incoherent talking. Dr. Thompson took large doses of the root, and found it to produce acceleration of the pulse, flushed face, drowsiness, and stiffness of the eyelids.[2] The following is a more recent illustration: An infusion of three drachms of the root in three gills of boiling water was ordered for a child four years of age, to be taken in eight equal doses at intervals of two hours. After the third dose the skin became hot and dry, the pulse 110 and irregular; the face, especially above the eyes, including the lids, much swollen; and the pupils widely dilated. There was strabismus of the right eye, and a wild, staring expression, giving the countenance a very singular, and in fact ludicrous appearance. Yet the intellect seemed to be unaffected. The tongue was very pointed and tremulous. On attempting to assume the erect position, the patient was seized with a general tremor, which passed off in a few seconds, and left her apparently quite exhausted.[3] The next morning all the alarming symptoms, with the tumefaction of the eyelids, had disappeared. Although these effects may be admitted to arise occasionally, they must be extremely rare in comparison with the innumerable instances in which spigelia is used as a remedy by physicians and in domestic practice. Dewees says: "We have prescribed this remedy many hundred times, and we declare we have never, except in a single instance, witnessed any distressing symptoms to arise from it; in this exception a slight squinting, with delirium, followed its exhibition."[4] Such, precisely, was Eberle's experience. It would seem highly probable that, as Chapman suggested, the purgative ingre-

[1] HOME, Clinical Experiments, p. 465.
[2] EBERLE, Thérapeutics, p. 155.
[3] SPALSBURY, Boston Med. and Surg. Journ., April, 1855, p. 72.
[4] Diseases of Children, p. 495.

dients of "worm tea" counteract the narcotic action of the spigelia contained in it.

Uses.—Barton long ago said, "It may be doubted whether there is in the whole series of anthelmintics yet known a more efficacious remedy against worms, especially the common *round worm*."[1] Dewees styles it "*the* most decidedly efficacious remedy;" according to Eberle, "it seldom fails;" and the almost universal employment of it in this country attests its value.

There is a state of intestinal derangement presenting all the symptoms of lumbricoid ascarides, and which is most frequently observed among strumous, feeble, and precocious children. They have fever, a dry hot skin, furred tongue, tumid and confined bowels, capricious appetite, and nervous irritability. These symptoms are often dissipated by the influence of spigelia, and without causing the discharge of any worms, to the presence of which they are most commonly attributed. It seems probable that the alterative and tonic effects of the medicine are not as fully appreciated and employed as they deserve to be. The fluid extract of spigelia and senna is well adapted to produce the results alluded to.

Administration.—Eberle proposed giving the decoction or infusion of spigelia alone, and subsequently administering a strong mercurial purge. The most usual and the best form of the medicine is that commonly known as *worm tea;* viz., ℞.—Spigelia, half an ounce; senna and fennel seed, of each one hundred and twenty grains; manna, one ounce; boiling water, one pint.—Infuse. Half a wineglassful three times a day to a child two years old. The compound fluid extract is less disagreeable and nearly as efficient. The dose is from *one to four fluidrachms.*

AZEDARACH.—Azedarach.

Description.—This medicine (which belongs to the secondary list of the U. S. Pharmacopœia) is the bark of the root of *Melia Azedarach*, a tree which is a native of Asia, but is naturalized in Southern Europe, and the southern States of the Union. It is generally known under the name of *Pride of China* or *Pride of India*, and is remarkable for its beautiful foliage and flowers, which have caused it to be used as a shade tree in several southern cities. It grows to a height of thirty or forty feet. The leaves are large, bipinnate, with dark green leaflets disposed in pairs. The flowers are of a light violet color, arranged in clusters near the extremity of the branches. Their odor, according to some authorities, is "disagreeable," and according to others "delightfully fragrant." The fruit is an ovoid fleshy berry, about the size of a cherry, and containing a nut with five seeds. The bark of the root has a bitter and nauseous taste and a virose smell.

History.—The poisonous properties of azedarach were well

[1] Barton's Cullen, ii. 413.

known to the Arabian physicians, one of whom enumerates among the symptoms which an overdose of it produces—faintness, confusion of mind, giddiness, dimness of sight, and vomiting. No mention is made of its vermifuge properties, but diuretic qualities are ascribed to it.[1] It was chiefly used to promote the growth of the hair, and to cure eruptions of the scalp. A modern writer praises the virtues of an ointment made with the pulp of the fruit in tinea capitis and to destroy lice.[2] Thacher mentions its being thus employed in the United States, and Michaux refers to its use in Persia for similar purposes.

Action. *On Animals.*—Birds devour the berries greedily and without harm. Cows have sometimes eaten the leaves in large quantities with but trifling inconvenience. Dogs appear not to be affected by them;[3] horses eat them with impunity, and the trees are sometimes planted around stables that these animals by eating the berries may be prevented from having the "bots."[4]

On Man.—The poisonous action of this medicine bears a close resemblance to that of spigelia. In a case described by Dr. Kollock,[5] the symptoms were stupor, dilated pupils, stertorous breathing, and subsultus. In another, mentioned by Tournon, there were convulsions, grinding of the teeth, cold sweat, vomiting and purging. Porcher, however, says that he has frequently seen the berries eaten by children in South Carolina without bad consequences. The poisonous effects are said to be most conspicuous in the spring, when the sap is ascending.

Uses.—Ainslie tells us that in Cochin-China, the medical men consider azedarach as *anthelmintic*, but administer it cautiously, because in too large a dose it causes vertigo and convulsions.[6] In the southern States of the Union, its use is said to be general among the planters, and with many to supersede all other vermifuges. Like spigelia, it is employed to remove the *dyspeptic symptoms* so often attributed to intestinal worms.

A case of *hysteria* said to have been cured by this medicine is reported by Skipton, of Calcutta, but his narrative lacks sufficient details on which to base an opinion of its correctness.[7]

Administration.—Azedarach bark is usually given in *decoction*, made by boiling two ounces of it in a pint of water, until reduced one-half. The dose for a child is *a tablespoonful* every two or three hours, until it affects the stomach or bowels. Or a similar dose of the decoction may be administered night and morning, for several days, and followed by an active cathartic. The dose of the *powdered bark* is *twenty grains*.

[1] EBN BAITHAR, ed. Sontheimer, i. 30.
[2] MÉRAT and DE LENS, Dic., iv. 290.
[3] COXE, Am. Dis., p. 128.
[4] PORCHER, Trans. Am. Med. Assoc., ii. 723.
[5] EBERLE, Therapeutics, p. 156.
[6] Materia Indica, ii. 455.
[7] Révue Méd., xxxii. 284.

PEPO.—PUMPKIN SEED.

This is the seed of *Cucurbito Pepo*, or common pumpkin, a plant too well known to require a formal description.

History and Use.—The earliest mention we have met with of the anthelmintic powers of pumpkin seeds, is contained in the following passage from Andry:[1] "Pumpkin and cucumber seeds are a very effectual remedy for the tapeworm, a fact which also rests on the testimony of Tyson, who, in his dissertation on the tapeworm, says that he has a portion of one twenty-four feet long, voided by a young man after he had taken an emulsion prepared with these two kinds of seeds." The result was referred, by Tyson, to the doctrine of signatures, on account of the resemblance of the joints of the worm to these seeds.

In 1820, Mongény, a physician in Cuba, recommended for the treatment of tænia a paste made of three ounces of fresh pumpkin seed pulp, which was followed for three successive hours with two ounces of honey. Within six or seven hours, the worm was discharged entire, even when other means had failed to dislodge it.[2] This method seems to have been introduced into Boston from Matanzas, by Dr. J. S. Jones, about 1850. The following formula was the one usually employed. Take two ounces of pumpkin seeds, from which the outer husk has been removed, pound them in a mortar with half a pint of water, until an emulsion is made, which may then be strained through a cloth. To be taken at one dose, fasting. If it does not operate within an hour and a half, take a dose of castor oil; and if unsuccessful, repeat the same on the following day. Cases of cure by these means began to multiply. The reader is referred to those of Mr. Craigin,[3] Rev. J. H. Hill,[4] Dr. Ely,[5] and Dr. De Forest,[6] who cured numerous cases in Syria. An interesting one was published by Dr. Patterson, of Philadelphia.[7] For six years, the patient had been tormented by his disease, and the use of all known remedies, including male fern, calomel and jalap, iodide of potassium, iodide of iron, decoction of pomegranate, and koosso. During this period he had voided upwards of four hundred yards of the worm. Finally he took two ounces of powdered pumpkin seeds with two tablespoonfuls of white sugar, infused in half a pint of boiling water. Within an hour and a half, an ounce of castor oil was administered, and in less than an hour afterwards, the worm, with the head, was discharged.

In 1852, two French physicians, MM. Brunet and Lamothe, apparently without any knowledge of the above mentioned results, also

[1] Génération des Vers (1741), ii. 536.
[2] RICHTER, Ausfurlich. Arzneim., i. 301.
[3] Boston Med. and Surg. Journ., Nov. 1851, p. 274.
[4] Ibid., April, 1852, p. 222.
[5] Ibid., July, 1852, p. 500, and Oct. 1852, p. 216.
[6] Ibid., Sept. 1852, p. 143.
[7] Med. Examiner, Oct. 1842, p. 630.

cured patients of tænia by means of a paste or emulsion of pumpkin seeds.[1]

In 1854, Dr. Leasure, of Newcastle, Pennsylvania, reported a successful case, and in the following year a second, occurring in the mother of his former patient.[2] Dr. Putnam, of Boston, also furnished another example of the tænifuge properties of pumpkin seeds,[3] which was followed by those of Ely,[4] Carpenter,[5] Soule,[6] Hunt,[7] Cazin,[8] Reimonecq,[9] and others. It is unnecessary to refer to any other particular examples. They might be almost indefinitely multiplied. The original success of the medicine has been more than confirmed by prolonged experience.

The *fixed oil* contained in the seeds is supposed to possess their anthelmintic virtues. It was used with success by Mr. J. C. Lyons, of Philadelphia, in the dose of half an ounce repeated in two hours, and followed in two hours more by a dose of castor oil.[10] This oil may be obtained by cold expression from the seeds in the proportion of nearly an ounce to the pound. It is clear, transparent, of a light brownish-green color, with a slight oily odor, and a perfectly bland taste, like that of the oil of sweet almonds.

Administration.—From one to two ounces of pumpkin seed, as fresh as possible, should be deprived of their outer envelope and beaten to a paste with finely-powdered sugar, and diluted with water or milk when taken. In order to secure its successful operation, no food should be taken for twenty-four hours before. Three or four hours afterwards one or two tablespoonfuls of castor oil should be administered.

KAMEELA.

Description.—Kameela, or *reroo*, is the Hindostanee name for a vermifuge which, after having been described and used by Dr. T. Anderson, a surgeon in the service of the East India Company, was introduced to the notice of western physicians by Dr. C. A. Gordon.[11] It was stated by him to be the pubescence on the stems and seed vessels of Rottlera tinctoria, a plant of the Nat. Ord. *Euphorbiaceæ.* It is an orange-red, granular, inflammable powder collected from the capsules of the fruit, and is with difficulty mixed with water. The granules are seen under the microscope to be mixed up with fine stellate hairs and remains of stalks, leaves, etc. It has little smell or taste, is insoluble in cold, and nearly so in boiling water, but dissolves readily in boiling alcohol and ether. One drachm of

[1] Annuaire de Thérap., 1852, p. 301.
[2] Am. Journ. of Med. Sci., July, 1854, p. 281; and ibid., June, 1855, p. 269.
[3] Ibid., Oct. 1854, p. 378.
[4] Boston Journ., Feb. 1856, p. 16.
[5] Ibid., Jan. 1858, p. 476.
[6] Ibid., March, 1859, p. 116.
[7] Am. Journ. of Med. Sci., April, 1859, p. 374.
[8] Bull. de Thérap., lv. 234.
[9] Lancet, March, 1859, p. 254.
[10] Philad. Med. Exam., Oct. 1853, p. 630.
[11] Times and Gaz., Nov. 1865, p. 538.

e saturated tincture yields about four grains of a resinous extract
aich is undoubtedly the active constituent of the medicine.

Action.—Dr. Gordon, in his account of kameela, states that
yond a trifling amount of nausea and griping, in some instances,
unpleasant effects are experienced from the remedy,[1] and the
servations of Mr. Leared are to the same purpose.[2] These state-
ents are substantially confirmed by other observers, who differ
ly as to the degree of nausea, vomiting, colic, or purging pro-
iced. In no case, however, is it represented to have been excessive.
ence we may infer that kameela should be ranked with vermi-
ges which exert a specific poisonous action upon intestinal worms,
upon tapeworms at least.

Uses.—It would appear that *tænia* is extremely prevalent in the
unjaub; but Dr. Gordon assures us that its treatment by kameela
so easy and certain that it was seldom necessary to admit a soldier
to a Military Hospital for that purpose. The soldiers, he says, ap-
ied of their own accord for a dose of the medicine, "after which
ey invariably parted with the worm in the course of a few hours,
id then went on with their military duty as if nothing had hap-
ned." If subsequent reports of its effects have in some degree
odified the belief in its uniform success, their account of its
eration still shows that kameela is one of the best remedies of
s class.

Respecting its action upon the worm there are different state-
ents. Mr. Leared mentions that the parasite is generally dis-
arged in pieces, or in large masses, in a lifeless state; and Messrs.
ardy, Anderson, and Moore always found it dead. Indeed, the
st named gentleman is persuaded that in kameela we possess not
ly the vermifuge, but the tæniacide *par excellence*. On the other
ind, the reporter of Dr. Peacock's cases states that the portions
the worm discharged under its influence were generally quite
ive. This discrepancy may, perhaps, depend upon a difference
the doses administered by the several physicians referred to.

Mr. Leared claims that the medicine is efficacious against all
rts of worms, and is incomparably superior to all other remedies
r *threadworms* and large *round worms*.[3] Dr. Moore thinks that it
also useful in *diseases of the skin*.

Administration.—The dose of the powder of kameela is from
xty to *one hundred and eighty grains*. Dr. Gordon states that in
idia he employed a saturated *tincture* in the dose of *one*, *two*, *or*
ree fluidrachms, diluted with a little cinnamon water. The *alco-*
lic extract is preferred by others; as above stated, about four
ains of it are yielded by *one fluidrachm* of the tincture. What-
er preparation is used should be repeated, in the doses mentioned,
ery three hours until five or six doses are taken. As the powder
kameela is apt to gripe, it should be associated with a small
antity of hyoscyamus.

[1] Times and Gaz., May, 1857, p. 429.
[2] Ibid., Dec. 1857, p. 628.
[3] Ibid., Jan. 1859, p. 56.

SAORIA is the dried herb of *Mæsapicta*, an Abyssinian shrub. It is taken in powder mixed with porridge, and in the dose of *an ounce or an ounce and a half.* It gives a violet tint to the urine, and occasions some nausea, and also liquid stools. Dr. Strohl, from whom these particulars are derived, is of opinion that it is a more certain tæniafuge and tæniacide than the remedies of the same class indigenous to France. Kuchenmeister regards its action as uncertain.[1]

ZATZE, or *Tatze*, is the fruit or undeveloped drupe of *Phytolacca dodecandra*, a native shrub of many parts of Africa and of the Azores. It has a persistently acrid and disagreeable taste, and is apt to produce vomiting and purging. Dr. Strohl found it partially successful in six cases of tænia. He administered from four to six drachms of the powder in a liquid vehicle.[2]

OLEUM TEREBINTHINÆ. Vid. *General Stimulants.*

[1] Annuaire de Thérap., xv. 261; Brit. and For. Med.-Chir. Rev., July, 1858, p. 248; KUCHENMEISTER, Syd. Soc. ed., i. 154.
[2] Bull. de Thérap., xlvii. 17, 71.

Class XII.

ALTERATIVES.

Alteratives are medicines which, in appropriate doses, modify the nutrition of the body without producing any antecedent phenomena. No other division of the materia medica contains more substances which, in large quantities, may become mischievous to the organization of the body, and even destructive to its life. They constitute some of the most powerful agents of the irritant class. Iodine, chlorine, the alkalies, mezereon, and colchicum are eminently of this nature, and some of the compounds of arsenic and mercury are violently poisonous; yet when duly administered, they silently penetrate into the most covert recesses of the diseased organism, and bring about such changes in its nutrition, or in the condition of its ultimate particles, as may result in their renovation and the return of health.

The term alteratives (alterantia) was, it is believed, first introduced by Hoffmann, who used the name, however, in a very wide sense, applying it to medicines which tend to correct *all morbid qualities in the body*, as distinguished from evacuants, tonics, and sedatives, which exhibit different modes of action. Alteratives themselves he divided into absorbents, refrigerants, incisives, or attenuants, and emollients or demulcents, but included only in the third division the alteratives of the present nomenclature, with many others which belong principally to the class of general stimulants, or, on the other hand, to diluent medicines. He distinguished between those which act chiefly on the humors, diluting and therefore rendering their movements more easy and unobstructed, and those which affect the solids, modifying their tone, contractility, elasticity, etc., and thus enabling them to circulate the fluids more rapidly and freely. These medicines, he remarks, are appropriately called purifiers of the blood, because they promote the removal from it of substances upon whose excretion health itself depends.[1] The exclusively solidist views which are often attributed to this eminent physician are therefore not those which he maintained. Indeed, he considered as alteratives many substances which exert a definite and active influence upon the secretions. Even mercury itself at that time was supposed to be curative in so far only as it

[1] Opera Omnia, i. 427 et seq.

increased the discharge of saliva; and probably he did not suspect the curative powers of this metal to be very great unless such an effect were produced by it. But it must be remembered that iodine, chlorine, colchicum, and arsenic, an observation of whose effects has chiefly led to the formation of the present class of alterative medicines, were unknown in Hoffmann's time, and the molecular changes which occur in nutrition were still undiscovered. Yet his doctrine, that alterative medicines promote the elimination of certain morbid matters from the body, is substantially in accordance with the conclusion of modern science.

Even now, physicians are not perfectly agreed what medicines to include in the class of alteratives. Some embrace under that denomination colchicum, guaiacum, mezereon, dulcamara, soda, potassa, sulphur, chlorine and its compounds with soda and lime, and others the vegetable acids, and the preparations of silver, zinc, copper, and lead. But all of these agents display properties which are more important than any which can be called alterative, and practical considerations, therefore, seem to determine their position elsewhere. Thus, colchicum modifies the renal secretion chiefly, and hence belongs to the class of diuretics; guaiacum acts mainly on the skin, and, therefore, is ranked with diaphoretics, etc. Even chlorine, which has so strong a chemical and physiological analogy with iodine, differs from it entirely in those respects which render iodine so valuable a remedy. What has been urged in the introduction, and repeated elsewhere, need not now be insisted upon— that the arrangement which is most convenient and useful in practice is the best in a practical treatise. Were the theory of medicinal agents perfected, its principles would of themselves constitute the most valuable practical precepts; but such a consummation, however desirable, is an utopian vision, if not an impossibility.

Throughout this work we have endeavored to keep prominently in view the principle that experience is the only safe guide in therapeutics. In attempting to elucidate the operation of many medicines, we have been enabled to seize with more or less confidence the link that connects their sensible operation with the cure which follows it. But in the present case that rational link is almost entirely wanting, and we are reduced to forming conjectures respecting its nature, derived from the effects of alterative medicines upon the economy when they are administered in excessive doses, and from our knowledge, imperfect though it be, of the intimate nature of the diseases in which their curative power has been demonstrated by experience.

It is a remarkable fact that mercury, arsenic, iodine, bromine, muriate of ammonia, soda, and potassa agree in this, that when given for a considerable period, which varies for them individually, they diminish the proportion of fibrin in the blood, its coagulability, or its crasis, or plasticity, as it is sometimes termed, and at the same time, promote the waste of the solids. Yet the exte phenomena which accompany this change are not the same i· case. Mercury causes a general disintegration of the solid

a wasting of them, and especially of glandular organs, bromine has a special action upon the nervous system, arsenic produces a flaccidity of the tissues, with a watery state of the blood, and the alkalies a dissolution of the corpuscles of this fluid, as well as an atonic condition of the solids, a state exactly represented by scurvy. It is certain, therefore, that if all of these medicines have the effect of impairing the normal constitution of the blood, they must do so by different processes, a conclusion which is fully supported by the fact that they are very far from possessing identical curative virtues. It is, indeed, quite impossible to substitute them for one another in the treatment of any disease, and sometimes, as in syphilis, the alterative remedy which cures the secondary is less efficient than another in curing the tertiary symptoms. This marked diversity of curative operation in two medicines so nearly related in many respects as mercury and iodine extends to other members of the same class, and proves that, although they all agree in diminishing the crasis of the blood, they evidently disagree in those more recondite influences and operations in which the true and intimate action of a medicine consists.

Such, briefly, are some of the elements out of which we may attempt to form a judgment respecting the manner in which alteratives cure disease; but their insufficiency is only too palpable. Yet if we attempt to push the inquiry further, we enter upon a boundless sea of conjecture where there is little else to guide us than more or less plausible hypotheses. We may assume that the affections which are cured by these medicines depend upon the presence of a specific morbid material in the blood, which alterative remedies are competent to neutralize or destroy, or simply to eliminate from the system. In favor of this view it may be stated that nearly all of the medicines in question are separated from the body with the urine, the secretion charged with evacuating the greater proportion of effete matters which the body throws off, and, therefore, in all probability, with removing the morbid principles which sustain the phenomena of disease, if such principles actually exist in the blood, just as iodide of potassium eliminates with the urine lead which has acted as a poison in the system.

Or, again, as indeed it seems more probable, the morbid phenomena may be sustained by the inability of the system to reject, not an actual poison, but the partially disintegrated and imperfectly vitalized particles which disease has left in all the organs to encumber and obstruct them; and alterative medicines may, by their direct stimulant action upon the ultimate organized particles, cause them to throw off their less vital portions, as a stimulant dressing applied to an indolent or sphacelating sore upon the skin quickens the vital movements of the part, and causes the separation of the sound from the unsound tissue. The influence of mercury on the absorption of false membrane, as it is evident to inspection in the case of iritis, renders it almost certain that one at least of the modes of cure by alteratives consists in the separation of the less from the more perfectly organized structures. And it is to be re-

membered that the greater number of alteratives, used as local applications, exert precisely the stimulant and conservative influence which is here referred to, and also that when administered internally, or outwardly applied, in excessive quantities, their most prominent action is a destructive one. It makes greatly in favor of this view to consider that when the medicines in question are employed too lavishly or too long, their destructive exceeds their curative operation; not only do they remove the particles whose discharge is essential to a cure, but they attack the sound tissues, and cause their separation also. In the case of several, this excessive activity is manifested by morbid phenomena of a definite character; mercury produces salivation, iodine a peculiar intoxication and a wasting of glandular structures, arsenic serous effusions, alkalies a scorbutic condition, etc.

There is a fact which is not without weight in determining which of the two preceding hypotheses inclines towards the side of probability. It is well known that for the cure of the primary phenomena of syphilis mercury is almost useless, and, indeed, is usually mischievous whenever it is applied to the treatment of these symptoms in persons of a feeble or cachectic constitution. Secondary syphilis, on the other hand, affecting the mucous membranes and the skin, is treated with incomparably better results by mercury than by any other single medicine, while the tertiary forms of the disease, seated in the fibrous tissues and the bones, yield to iodide of potassium much more readily than to mercury. Now, if mercury were the specific antagonist and antidote of the venereal poison, it should act as such in all cases and stages of the disease; but if, instead of regarding it as adapted to neutralize a material poison, as an alkali neutralizes an acid, we assume either that the tissues which admit mercury will not admit iodide of potassium into their minute recesses, or *vice versa;* or else that the affinity of the two medicines is different for the two sorts of structure involved in the disease, in a word, that the one is competent, and the other is not, to accomplish the due degree of waste and repair in the diseased tissues, we adopt an explanation which is consistent with the facts of the particular case, and with the analogies presented by alterative medicines in their action upon the skin and mucous membranes, when administered in large doses. The idea which Hoffmann entertained of the operation of diluent alteratives was substantially that which is here set forth, and it is the same which we have elsewhere maintained as the most plausible explanation of the efficacy displayed by pure and slightly mineralized waters, and, above all, by the water-cure, in the treatment of many chronic diseases.

It is a further argument in favor of this hypothesis, that alterative medicines act, to a great degree, in the same direction as the diseases which they cure; that mercury, for example, tends to produce lesions which bear a close resemblance to, if indeed they are not identical with, those caused by syphilis. Just as a caustic, which is capable of occasioning an ulcer, is the most appropriate agent for healing an ulcer which has fallen into an indolent condi-

tion, provided it be applied in a degree duly proportioned to the imperfect vitality of the affected part. If too slightly used, it is inefficient; if too actively applied, it extends and deepens the original sore, just as alterative medicines in proper doses seem gently to remove the obstacles to recovery, but, too profusely administered, undermine the strength of the system, and institute destructive instead of sanative processes.

HYDRARGYRUM.—MERCURY.

Description.—Mercury is a very widely distributed mineral. The principal mines which furnish it to commerce are those of Idria, in Germany, of Rosenau and Niederland, in Hungary, of Almaden, in Spain (where it was obtained by the Greeks seven hundred years before Christ), of Guanuelica, in Peru, and of New Almaden, in California. It is also procured in Japan and Siberia. It is usually found combined with sulphur in native cinnabar, which is a bisulphuret of mercury. From this it is extracted by distillation, the sulphurous vapors being made to unite with unslaked lime or iron slag.

At ordinary temperatures mercury is a grayish white, shining liquid, without taste or smell, and is not tarnished by exposure to the air. From these qualities it acquired its name, *hydrargyrum*, a word derived from ʽυδωρ, water, and αργυρος, silver, and meaning liquid silver. It is the heaviest of all the metals except gold and platinum. At 39.2° F., its specific gravity is 13.5886. At —39° F. it congeals into a tough crystalline solid of octahedral or acicular structure, which emits a dull sound like lead when struck, is flexible and malleable, and by contact with the skin whitens it and produces a burning sensation. Its boiling point is about 662° F., but it volatilizes at ordinary temperatures. Mercury is susceptible of very minute division. It can be forced through the pores of leather, and by agitation with unctuous substances, with oil of turpentine, sulphur, alcohol, ether, etc., it loses its liquid character. In this manner it may be reduced to a gray powder, formerly known as *Æthiops per se* (*Hydrargyri Oxidum Nigrum*). By union with other metals it forms *amalgams*.

Among acids the nitric acts upon metallic mercury the most readily and at ordinary temperatures. Boiling sulphuric acid combines with it, and muriatic acid unites with its oxides.

The officinal preparations of mercury are very numerous, and will be briefly described, beginning with those of the metal itself.

EMPLASTRUM HYDRARGYRI.—*Mercurial Plaster.*

This plaster is made with mercury six troyounces, olive oil and resin each two troyounces, and lead plaster twelve troyounces.

HYDRARGYRUM CUM CRETA.—*Mercury with Chalk.*

Three troyounces of mercury rubbed with five troyounces of prepared chalk produce this useful medicine.

Pilulæ Hydrargyri.—*Pills of Mercury; Blue Pills.*

These pills are made from a mass composed of three hundred and eighty-four grains of mercury rubbed up with five hundred and seventy-six grains of confection of rose, and then beaten with one hundred and ninety-two grains of powdered liquorice-root, and divided into three hundred and eighty-four pills.

Unguentum Hydrargyri.—*Mercurial Ointment.*

The directions for making the ointment are to take twenty-four troyounces of mercury, lard and suet of each twelve troyounces; rub the mercury with a troyounce of suet and a small portion of the lard until the globules disappear, then add the remainder of the lard and suet softened by a gentle heat, and mix them.

Hydrargyri Oxidum Flavum.—*Yellow Oxide of Mercury.*

It is procured from a solution of corrosive chloride of mercury by precipitation with solution of potassa.

Unguentum Hydrargyri Oxidi Flavi.—*Ointment of Yellow Oxide of Mercury.*

This ointment is made by incorporating *sixty grains* of yellow oxide of mercury, with four hundred and twenty grains of ointment.

Hydrargyri Oxidum Rubrum.—*Red Oxide of Mercury; Red Precipitate.*

It is prepared by the action of diluted nitric acid upon mercury. A portion of the nitric acid is decomposed, forming an oxide of mercury with which another portion of the acid unites. On the application of heat nearly all of the nitric acid is driven off, leaving a deutoxide of mercury mixed with a variable proportion of the nitrate. This oxide consists of one equivalent of mercury and two of oxygen, is an orange-red powder, and has a disagreeable metallic taste. It is entirely soluble in muriatic acid, but is very slightly so in water.

Unguentum Hydrargyri Oxidi Rubri.—*Ointment of Red Oxide of Mercury; Red Precipitate Ointment.*

This ointment consists of sixty grains of the red oxide of mercury finely powdered, and four hundred and twenty grains of ointment.

Hydrargyri Sulphuretum Rubrum.—*Red Sulphuret of Mercury; Cinnabar.*

One part of melted sulphur to five of mercury, by weight, are mixed over the fire. When cold the mass is reduced to powder and sublimed. Cinnabar is composed of one equivalent of mercury and two of sulphur. It is usually in the form of dark red crystalline masses, of brilliant aspect and fibrous texture. Reduced to powder it forms the pigment *vermilion.* It is inodorous and tasteless, and is insoluble in water, alcohol, or ether. Its sp. gr. is 8.1.

Hydrargyri Chloridum Mite.—*Mild Chloride of Mercury; Calomel.*

"Take of Mercury, *forty-eight troyounces;* Sulphuric Acid, *thirty-*

six troyounces; Chloride of Sodium, *eighteen troyounces;* Distilled Water, *a sufficient quantity.* Boil, by means of a sand-bath, twenty-four troyounces of the Mercury with the Sulphuric Acid, until a dry, white mass is left. Rub this, when cold, with the remainder of the Mercury, in an earthenware mortar, until they are thoroughly mixed. Then add the Chloride of Sodium, and having rubbed it with the other ingredients until the globules cease to be visible, sublime the mixture into a large chamber, so that the sublimate may fall in powder. Wash the sublimed matter with boiling Distilled Water, until the washings afford no precipitate upon the addition of solution of Ammonia, and dry it."—*U. S. P.* By the first step in this process, a persulphate of mercury is formed, which, by trituration with mercury, is converted into the subsulphate. By the trituration and sublimation of the latter with chloride of sodium, calomel or subchloride of mercury is sublimed, and the residuum is sulphate of sodium. The calomel is then finely powdered and washed, to free it from the bichloride, which is known to be entirely removed when ammonia ceases to give any precipitate with the washings.

Sublimed calomel is usually in the form of a semitransparent, white, fibrous cake, studded upon its surface with crystals, which are four-sided prisms. When scratched, it displays a characteristic yellow streak. As commonly sold, calomel is in the state of a white or yellowish-white heavy powder. Its sp. gr. is 7.2. It has neither smell nor taste, is insoluble in water, alcohol, or ether, and blackens by long exposure to the light. By the addition of lime-water, a partial decomposition takes place, chloride of calcium remains in solution, and black protoxide of mercury is precipitated, and remains mixed with undecomposed calomel. The preparation so procured is known as *lotio nigra* or *black wash.*

PILULÆ CATHARTICÆ COMPOSITÆ.—*Compound Cathartic Pills.*

"Take of Compound Extract of Colocynth, thirty-two grains; Extract of Jalap, in fine powder, and mild Chloride of Mercury, each twenty-four grains; Gamboge, in fine powder, six grains. Mix them together; then with water form a pilular mass, to be divided into twenty-four pills." Dose, from *two* to *four pills.*

HYDRARGYRI CHLORIDUM CORROSIVUM.—*Corrosive Chloride of Mercury; Corrosive Sublimate.*

"Take of Mercury, twenty-four troyounces; Sulphuric Acid, thirty-six troyounces; Chloride of Sodium, eighteen troyounces. Boil, by means of a sand-bath, the mercury with the sulphuric acid until a dry white mass is left. Rub this, when cold, with the chloride of sodium, in an earthenware mortar; then sublime with a gradually increasing heat."—*U. S. P.*

By boiling sulphuric acid with mercury, a persulphate of mercury is formed. When this is mixed with chloride of sodium, and the mixture is duly heated, the chlorine combines with the mercury, and forms a sublimate, while sulphate of sodium remains behind. The sublimate was formerly regarded as a bichloride of mercury, but

the most correct view probably is that it consists of one atom each of mercury and chlorine, and hence that it is a chloride, or, relatively to calomel, a perchloride of mercury.

Corrosive chloride of mercury is usually kept in white, semi-transparent, crystalline masses, or as a white powder. It is inodorous, but has an extremely acrid, styptic, metallic and persistent taste. It is permanent in the air, is soluble in sixteen parts of cold and three of boiling water, in three parts of alcohol, and in four parts of ether, which, also, by agitation, removes it from its solution with water. Its solubility is much increased by the addition of hydrochloric acid, or of the alkaline chlorides.

Incompatibles.—A solution of corrosive chloride of mercury gives a yellow or red precipitate with hydrates of potassa, soda, or lime; a white one with ammonia; a scarlet one with the iodide of potassium; and a black one with sulphuretted hydrogen. It is decomposed by tartar emetic, nitrate of silver, acetate of lead, soaps, almond emulsion, solution of tannin, etc., and forms compounds with albumen and fibrin, which, unless recent, are little affected by acid or alkaline solutions, or by those of the alkaline chlorides.

HYDRARGYRUM AMMONIATUM.—*Ammoniated Mercury; White Precipitate.*

This compound is procured by precipitation with ammonia from a solution of corrosive chloride of mercury, and is described as an ammonio-chloride of mercury.

Ammoniated mercury is in the form of a coarse snow-white powder of a styptic metallic taste, but without smell. It is insoluble in water and alcohol, but is decomposed by boiling water, and is dissipated by a strong heat. White precipitate may be distinguished from calomel by lime water, which does not alter the former, but blackens the latter.

UNGUENTUM HYDRARGYRI AMMONIATI.—*Ointment of Ammoniated Mercury.*

It is made by mixing *forty grains* of ammoniated mercury in fine powder with *a troyounce* of ointment.

HYDRARGYRI IODIDUM RUBRUM.—*Red Iodide of Mercury.*

This preparation is procured by precipitation from a solution of bichloride of mercury by means of iodide of potassium, the chloride of potassium remaining in solution.

Deutiodide of mercury may be obtained in rhomboidal crystals by sublimation, but is usually in the form of a brilliant scarlet powder, of a slight metallic taste, but without odor. It is insoluble in water, but is soluble in alcohol and acids with the aid of heat; also in a boiling solution of chloride of sodium, and in solutions of iodide of potassium and chloride of sodium.

HYDRARGYRI IODIDUM VIRIDE.—*Green Iodide of Mercury.*

A troyounce of mercury is triturated with three hundred grains of iodine reduced to a paste by means of alcohol, until combination between the two bodies ensues. As prepared for use, this iodide of

mercury is a powder of a dull greenish-yellow color, insoluble in water and alcohol, but soluble in ether. It is without smell or taste.

UNGUENTUM HYDRARGYRI IODIDI RUBRI.—*Ointment of Red Iodide of Mercury.*

This ointment contains sixteen grains of red iodide of mercury to a troyounce of ointment.

LIQUOR ARSENICI ET HYDRARGYRI IÒDIDI.—*Solution of Iodide of Arsenic and Mercury; Donovan's Solution.*

This is a solution of iodide of arsenic and red iodide of mercury, each thirty-five grains, in half a pint of distilled water.

HYDRARGYRI CYANIDUM.—*Cyanide of Mercury.*

"Take of ferrocyanide of potassium, five troyounces; sulphuric acid, four troyounces and one hundred and twenty grains; red oxide of mercury, in fine powder, water, each, a sufficient quantity. Dissolve the ferrocyanide of potassium in twenty fluidounces of water, and add the solution to the sulphuric acid, previously diluted with ten fluidounces of water, and contained in a glass retort. Distil the mixture nearly to dryness into a receiver containing ten fluidounces of water and three troyounces of red oxide of mercury. Set aside two fluidounces of the distilled liquid, and to the remainder add, with agitation, sufficient red oxide to destroy the odor of hydrocyanic acid. Then filter the solution, and having added the reserved liquid, evaporate the whole in a dark place in order that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle, protected from the light."

Cyanide of mercury crystallizes in rectangular prisms, which are sometimes transparent, but usually opaque, and of a white color. It has an unpleasant metallic taste. It is unaffected by exposure to the air, and dissolves in eight parts of water at 60°, and more readily in hot water. It is very sparingly soluble in alcohol.

HYDRARGYRI SULPHAS FLAVA.—*Yellow Sulphate of Mercury; Turpeth Mineral.*

Six troyounces of sulphuric acid and *four troyounces* of mercury are boiled to dryness in a glass vessel. The white mass which remains is reduced to powder and mixed with boiling water. The yellow precipitate is then washed with hot water and dried.

Turpeth mineral is a powder of a lemon-yellow color and of an acrid taste, but inodorous. It is nearly insoluble in water.

LIQUOR HYDRARGYRI NITRATIS.—*Solution of Nitrate of Mercury.*

This preparation is obtained, by dissolving three troyounces of mercury in five troyounces of nitric acid and six fluidrachms of distilled water with the application of heat and subsequently evaporating the solution to seven troyounces and a half.

UNGUENTUM HYDRARGYRI NITRATIS.—*Ointment of Nitrate of Mercury.*

This ointment is prepared by dissolving with heat a troyounce

and a half of mercury in three troyounces and a half of nitric acid, and adding to the solution sixteen and a half troyounces of lard.

History.—The first distinct account of quicksilver is contained in Pliny's *Natural History*.[1] This writer described a method of obtaining it from minium by sublimation, and says that it resembles silver in color and water in fluidity. He further remarks that it may, perhaps, be used externally as an astringent or hæmostatic, but care must be taken to prevent its entrance into the body by wounds or otherwise, for, as he says, it is a poison, and to employ it as a medicine would be rash. Dioscorides furnishes a still more meagre description.[2] Galen professes that he knows nothing about its internal or its external operation, and least of all whether, as had been asserted, it sometimes produced fatal effects. The Arabians employed mercurial preparations in the treatment of itch and other cutaneous affections. Ebn Baithar quotes Aristotle (?) as stating that it is poisonous to mice; that its vapors occasion paralysis, trembling, loss of hearing, fainting, paleness, and a tottering gait; and also that it wastes the limbs and causes ulcers of the mouth. He further remarks that birds and reptiles shun the place where mercury is manufactured, and that it preserves peltry from the moths.[3] Rhazes describes its passing unchanged through the intestines, particularly if exercise be taken, and adds that it causes no mischief beyond pain in the stomach and bowels. Serapion states that its fumes occasion nervous affections and paralysis, and Alsaharavius is said[4] to be the only ancient author who has mentioned swelling and ulceration of the mouth as effects of its being rubbed upon the skin. Ainslie remarks that it may be doubted whether the natives of India were not before the Arabians in the use of mercury.[5] Klein, in a work on the treatment of syphilis in the east, alleges that this disease was known and treated with mercury by the Malabar physicians as early as the ninth century:[6] and Captain Sykes states that the Hindoos claim to have induced salivation by the inhalation of mercurial vapor from time immemorial.[7]

The employment of mercury in Europe was borrowed from the Moors in Spain, and from the Saracens during the Crusades; but as yet it was only applied externally in the form of inunction or fumigation. In the thirteenth century its effects were described by Theodoric, a friar, and afterwards Bishop of Cervia, and in the following century, its operation upon the mouth was mentioned by Guy de Chauliac.[8] After the development of syphilis, in the fifteenth century, the virtues of the medicine became more generally known. Freind states that it was first recommended by Johannes de Vigo for confirmed syphilis, and Douglas ascribes to

[1] Lib. xxxiii. cap. 41.
[2] Lib. v. cap. 70.
[3] Ed. SONTHEIMER, i. 554.
[4] PAULUS ÆGINETA (Syd. Soc. ed.), ii. 239.
[5] Materia Indica, i. 545.
[6] ROSENBAUM, Geschichte der Lustseuche, p. 67.
[7] Lond. Med. and Phys. Journ., March, 1827.
[8] FREIND, Hist. of Physic., ii. 361.

Berengarius the first use of mercurial inunctions in syphilis. According to Astruc, the internal as well as the external use of mercury for this disease was proposed by Clowes, an English surgeon, who wrote in 1535, but the innovation is also attributed by Alston to Paracelsus, who died A. D. 1541.[1] It is probable that neither of these statements is strictly accurate, for in 1540, the pills of Barbarossa, a native of Mitylene, and a famous corsair, became celebrated from their having cured Francis I. of syphilis. Barbarossa, who had obtained the receipt for these pills from a Jewish mountebank, sold it to the French monarch.[2] According to various accounts they contained, besides mercury, musk, flour, rhubarb, turpentine, etc. It is, however, certain that the introduction of mercurials as internal medicines is chiefly to be attributed to Paracelsus and his followers. Matthiolus, who was nearly contemporary with him, speaks of their being used internally as antisyphilitic remedies.[3] In 1667, corrosive sublimate was first used internally. Still the method by inunction continued to be regarded with preference, as the practice of Wiseman, Sydenham, Astruc, and even Hunter, sufficiently proves.[4]

Gradually the employment of mercury in other diseases than syphilis was introduced. Zacutus Lusitanus (Ob. 1642) used it in a great variety of affections; Fabricius von Hilden wrote of its employment in gout and rheumatism, but not favorably. Van Helmont first published its anthelmintic virtues, and Bertini prescribed it in exanthematous fevers and in inflammations. Belloste, who styled it "one of nature's miracles, and a most rare gift of Providence," published an account of its remarkable effects in secondary syphilis, scrofula, and indurations.[5] The preparation of *calomel* was long a secret, but one of the methods of procuring it was made known by Béguin in 1608. Its name, which signifies "beautiful black," was applied to it by Sir Theodore Mayerne, in compliment to a negro who assisted him in preparing it. In opposition to corrosive sublimate, which was also called *draco ferox*, calomel was named *draco mitigatus*. *Manna metallorum*, *sublimatum dulce*, *mercurius dulcis sublimatus*, are other names which it bore expressive of the comparative mildness of its operation. Richter has remarked truly that the gradual extension of the use of mercury depended far more upon a direct experience of its virtues, than upon the scientific and often plausible theories invented to explain its operation, and which, not unfrequently, led to gross errors in practice. Such, indeed, is always the case, when theory ceases to be contented with its legitimate office of gathering into sheaves the harvest of facts reaped by independent laborers in the field of science.

Action of Metallic Mercury. *On Animals.*—The ancients, as

[1] Alston, Mat. Med., i. 83.
[2] Voigtel, Arzneimittellehre, ii. 277. Richter, op. cit., v. 300.
[3] Comment., lib. v. cap. lxx.
[4] Lane, Lect. on Syphilis, Lancet, 1841–42, i. 286.
[5] Traité du Mercure, 1695.

already intimated, were aware that mercury was destructive of lice, intestinal worms, and many *insects*. They employed it for ridding sheep, and other animals, of cutaneous parasites. Even now, it is well known, mercurial ointment is the surest agent for destroying pediculi pubis.[1] It is equally fatal to the larvæ of insects, and the unhatched young of birds. Gaspard hung a piece of fly-blown meat over mercury, at a favorable temperature, but not a single egg matured. He obtained similar results with the eggs of crickets.[2] The same experimenter found that hens' eggs put to hatch over mercury remained undeveloped, and that in such of them as already contained a chick, it perished.

When rubbed upon the skin of quadrupeds, mercurial ointment induces salivation, with the usual accompaniments of this process witnessed in man. Schubarth for twenty-nine days had a horse anointed with mercurial ointment to the extent of eighty ounces. By the destructive distillation of blood obtained from the animal before and after death, metallic mercury was obtained.[3] Zeller performed a similar experiment. In cats that had for some time been rubbed with mercurial ointment, Oesterlen found minute globules of mercury in the pancreas, liver, spleen, lungs, heart, mesenteric glands, kidneys, etc., and also in the urine, bile, milk, and saliva; but none could be detected in the nervous centres, nor in the salivary glands, although salivation had taken place.[4] Overbeck[5] found that rabbits and cats died after being anointed for several days with mercurial ointment. But dogs resisted the influence of the treatment for three or four months, when they displayed evidences of mercurial cachexia of a high grade, such as inflammation and ulceration of the mucous membrane of the mouth, throat, stomach, and intestine, and of the skin, with hyperæmia of the liver. The bones were unaffected, and no interstitial plastic deposit was met with. Metallic mercury was found in the blood, and in the kidneys, intestines, liver, and salivary glands. Traces of it were also detected by chemical processes in the bones, but none was visible on microscopic examination. Neumann, by means of careful experiments both on animals and men, on parts of the body destined to amputation, and finally, on the bladder and the pericardium, found that when baths of corrosive sublimate had been applied for several hours to the trunk of an animal's body, the presence of mercury in the internal organs was demonstrable. He also concluded that when mercurial ointment is rubbed into the unbroken skin, mercurial globules pass into the hair sheaths and bulbs, into the superficial sebaceous glands and the sweat glands.[6] If metallic mercury is injected into the veins, it is carried to the right side of the heart and into the lungs, where it occasions the formation of small abscesses, each one of which contains within it a globule of mercury, and is surrounded by a portion of hepatized lung tissue. In none

[1] GIACOMINI, Mat. Med., p. 424
[2] Journ. de Physiol. Exper., i. 165.
[3] WIBMER, Wirkung, etc., iii. 91.
[4] Archiv für Physiol. Heilkunde, 1843.
[5] Prager Vierteljahrs., lxviii. 33.
[6] Practitioner, vii. 279.

of such experiments does the mercury appear to reach the left side of the heart. Mr. Ancell quotes an experiment in which metallic mercury was thrown into the jugular vein of a dog. Within twenty-four hours, great difficulty of breathing ensued, and death on the fourth day. The pulmonary pleura was raised in many places in the form of blisters, containing bloody pus, and globules of mercury. Magendie's experiments are to the same effect.[1] When injected into the arteries, in like manner, it does not visibly proceed further than the capillary network of these vessels. It there, however, as in the lungs, deranges the functions of the part, and excites suppurative inflammation. It is said that in the neighborhood of the furnaces for roasting mercurial ores in Idria, cows are salivated, grow cachectic, and abort; their calves also are feeble. In fish-ponds supplied by the waters of streams into which the hot slag is thrown, the trout lose their mottled color.

On Man.—Wibmer has collected a number of cases in which metallic mercury was taken without serious harm, in doses of from several ounces to two pounds. In one case, however, ascribed to Albano, death is attributed to the effects of the medicine; and in others more or less salivation ensued. At one time in England crude mercury was taken by ladies to beautify the complexion, and the name of Dr. Dover is familiarly associated with this extravagant custom. Mr. Bradley gives the history of an old gentleman who daily, for nine months, took an ounce of quicksilver, without its doing him either good or harm; and out of sixteen pounds he had thus taken, all but an ounce and a half was recovered from the fæces.[2] In the greater number of cases as in this one, the mercury appears to have been voided, without doing any injury to the patient; but sometimes, besides causing the rupture of a diseased bowel, it occasioned salivation. Two such cases are related by Mead, and one of them proved fatal.[3]

Considering that the phenomena of mercurialism are so familiar to every medical observer, it seems almost incredible that a doubt should have been entertained at any time of the absorption of mercury into the system. Yet the influence of a medical theory availed to discredit so evident a truth. In this country, we find that one of the few contributions of Dr. Physick to medical literature is an experimental essay to prove that mercury is not absorbed, because with his reagents he was unable to find traces of it in the blood or saliva of persons who had been treated by it. He was disposed to believe that mercury acted "sympathetically."[4] Yet numerous cases were then on record proving the sensible presence of mercury in the dead bodies of persons who, in their lifetime, had used preparations of this medicine. Even in 1767, Barry described the circulation of mercurial globules through the bloodvessels, acting there as a deobstruent, and referred to cases related by Fernel and by Fallopius, where the metal was found in the bones, etc., of venereal

[1] Lancet, June, 1840, p. 443.
[2] SIGMOND, Mercury, Blue Pill, etc., p. 16.
[3] Medical Works, p. 76.
[4] Med. Repository, v. 288.

patients.[1] Other analogous cases are recorded by Wibmer and by Richter, and also by Bonetus and Lieutaud.[2]

Van Hasselt proved the absorption into the blood of pure, metallic quicksilver,[3] and met the objection that the oxide only is absorbed, and afterwards reduced in the system, by showing that gold leaf forms an amalgam with mercury when suspended over this metal in vacuo. Dumeril obtained mercury by scraping the walls of hospital wards where venereal patients were treated with this medicine. Colson, also, states that (in 1821–23) he and several other *internes* and *externes* of the venereal wards of the Hôpital de la Pitié were salivated by the mercurial atmosphere, nor did they get rid of the affection while they continued to frequent those wards.[4] Similar examples had previously been given by Goulard.[5]

Among the proofs of mercurial absorption by man, the following may be selected: In 1810 Brückmann published an account of a lady who, a year after being salivated, having become heated by violent dancing, dark mercurial stains appeared upon her breast, and metallic mercury was found in her linen. In 1813, Jourda collected a quantity of mercury from the urine of a syphilitic patient who was taking this remedy.[6] Fourcroy refers to a gilder of metals affected with phlyctenæ of the thighs, the serum from which gave distinct evidence of the presence of mercury.[7] Cantu, in 1823, announced his having detected mercury in the urine of a patient treated by mercurial frictions. Elk and Buchner obtained it from the blood of persons who had been salivated, and Engelhard from the pus of an ulcer in like circumstances.[8] In 1824, Colson found that a brass plate, after lying for some time in the blood of a person treated by mercury, became covered with a coating of this metal.[9] Walter Pope mentions a workman who, for six months, had not handled mercury, yet rendered a piece of copper as white as silver by rubbing it between his fingers. A man who had been treated for syphilis, both internally and externally, observed, two months after the termination of the cure, minute globules of mercury upon the skin of the chest, and on other parts; and in a child who had taken a few grains of mercury for a bowel affection, globules of mercury were afterwards seen in the pus discharged by an abscess in the axilla.[10] Biett obtained mercury from the axillary glands of a mercurialized syphilitic patient, after his prolonged use of the warm bath. By very careful manipulation, Gmelin detected mercury in the saliva of a person salivated by mercurial frictions.[11] Oesterlen, in pursuing the experiments above referred to, likewise obtained mercury from the

[1] Trans. Lond. Coll. Phys., i. 1858.
[2] Consult also HUFELAND'S Journ. (1820), ii. 117, and a large number of examples collected by VIRCHOW, Archiv, xviii. 364.
[3] OESTERLEN, Heilmittellehre, p. 101.
[4] Recherches sur l'Action du Mercure; Arch. Gén. xii. 68.
[5] VAN SWIETEN'S Comment., xvii. 261.
[6] Journ. de Méd., xxvii. 244.
[7] Trad. de Ramazzini, Chapter II., note.
[8] RICHTER, op. cit.
[9] Archives Gén., xii. 86.
[10] Bull. de Thérap., lxxi. 44.
[11] Ibid., xiii. 348.

saliva. Andouard detected it in the same secretion, and also in the urine;[1] Gorup Besanez extracted it from the liver,[2] and Lehmann, by numerous and conclusive experiments, has confirmed all of these results. These statements have also been fully sustained by the observations and experiments of Overbeck,[3] Schneider,[4] and others. It may be added that Heller, of Vienna, has reported two cases of pregnant women who aborted during a course of mercurial inunction. In both cases mercury was detected in the bodies of the children.[5] It is related by Lieblingen that three persons affected with scabies were rubbed all over with mercurial ointment. They lived together in a close damp room, and there they were found dead. Besides the usual evidences of mercurial action on the mouth there was found ecchymosis of the skin, general fluidity of the blood, and congestion of the brain and lungs. In the lungs and kidneys mercury was detected by chemical analysis.[6]

When mercury has been taken so as to produce its constitutional effects, and these have entirely disappeared, they may long afterwards be re-excited by the action of medicines which are decomposed in the system, and form soluble compounds with mercury. One of these is iodide of potassium. Melsens, therefore, proposed it as a cure for symptoms which depend upon mercury retained in the economy. (Vid. *Iodide of Potassium.*) Dr. Budd relates a case in support of this view. A young man had secondary syphilis with partial paraplegia, and, about five months before, had had primary symptoms which were treated with mercury. In the interval he had taken none. For the constitutional symptoms iodide of potassium was freely administered, and, in a few days, the patient was profusely salivated, presenting all the symptoms of mercurial ptyalism, including the characteristic fetor of the breath. Complete recovery followed.[7] This subject has also been illustrated by Lorinser, who considers iodide of potassium useful in those cases only of constitutional syphilis in which the body has been impregnated with mercury.[8] Some examples, tending to show the power of iodide of potassium to revive mercury in the system, have been related by Dr. Lyman[9] and others. It is certain, also, that the habitual use of mercury increases the susceptibility to its morbid action. Dr. Farquharson relates the case of a lady who during a residence in the West Indies had been treated for remittent fever with large and repeated doses of calomel. Afterwards, on her return to England, she took three grains of calomel with colocynth,

[1] Am. Journ. of Med. Sci., Jan. 1844, p. 235. For other illustrations, see BUMSTEAD's edition of HUNTER and RICORD on the Venereal Disease, p. 441.
[2] Times and Gaz., July, 1857, p. 34.
[3] VIRCHOW's Archiv, xxii. 419.
[4] Prager Vierteljahrs., lxxii., Anal., 30.
[5] Times and Gaz., Sept. 1861, p. 251.
[6] Boston Med. and Surg. Journ., Mar. 1870, p. 219.
[7] Brit. and For. Med.-Chir. Rev., xi. 202.
[8] Archives Gén., 5ème sér., xiii 346.
[9] Boston Med. and Surg. Journ., March, 1859, p. 142.

and suffered profuse salivation, the consequences of which were of long duration.[1]

If now we recall the cases which illustrate the influence of mercurial emanations, the evidence will become complete. One of these has frequently been quoted, but is too striking to be omitted here. In April of the year 1810, the *Triumph*, man-of-war, and the *Phipps*, schooner, saved from the wreck of a Spanish ship, off Cadiz, a large quantity of quicksilver. The *Triumph* took on board thirty tons, contained in leathern bags of fifty pounds each; these bags were picked up on the shore, and although saturated with sea-water, were collected and stowed below. In about a fortnight many of them decayed and burst, and the mercury escaped into the recesses of the ship, where it became mixed with bilge water, the emanations from which speedily coated every metal with quicksilver. Nearly all of the crew were salivated. The quantity on board the *Phipps* was not so great, but she was sent to Lisbon to be cleared by boring a hole in her bottom to allow the quicksilver to run out. Every rat, mouse, and cockroach on board was destroyed, and the symptoms of salivation appeared among the crew in a high degree.[2]

A narrative is published by M. Grapin, concerning four persons, members of the same family, and occupying the same ill-ventilated room, who were profusely salivated by the fumes of a piece of a wooden bowl that had been used to collect the sweepings from the floor of a looking-glass manufactory. The stove in which the bowl was burned and its pipe also were not close, and during the combustion a mecurial smell pervaded the room.[3]

In this connection it may be stated that when syphilis is treated by mercurial inunctions, and proper precautions are taken to prevent the patients from inhaling the emanations of the mineral, salivation is quite an exceptional occurrence.[4] It would appear probable, therefore, that salivation may be due, in part, at least, to the local action of mercury upon the lining membrane of the mouth.

The effects of mercurial vapors upon a large scale are illustrated by the condition of the inhabitants of districts where the ores of mercury are smelted. The whole population of Idria, we are told, is subjected to their influence. The annual mortality is more than one in forty. Premature births and abortions are very common.[5] By an extensive observation of male and female operatives exposed to mercurial vapors, Dr. Lizé has arrived at the conclusion that marriages among them are productive of vastly more abortions, stillbirths, and feeble children which seldom arrive at maturity, than among persons of the same social class engaged in other pursuits.[6] Besides the nervous affections described below, the workmen are liable to congestion and swelling or atrophy of the liver,

[1] British Med. Journ., Feb. 1873, p. 136.
[2] Phil. Trans. Pt. II. p. 402; SIGMOND, on Mercury, p. 11.
[3] Archives Gén., 4ème. sér., viii. 327.
[4] KIRCHGASSER, VIRCHOW's Archiv, xxxii. 145.
[5] HERMAN, Prager Viert., lxii., Anal. 27. [6] Arch. Gén., Fev. 1863, p. 229.

inflammation and abscess of the lymphatic glands, salivation, neuralgia of the fifth pair, various eruptions and ulcers of the skin, swellings, etc., of the lymphatic glands, periosteum, and bones.[1]

Among the older writers, Camerarius, Fernel, Forestus, Fallopius, Etmüller, and De Haen, record examples of trembling and chronic poisoning caused by mercurial emanations, and Ramazzini and others describe their disastrous effects upon miners, gilders, mirror manufacturers, barometer makers, etc. Of these, the best description is furnished by Mérat, under the name of *mercurial trembling*.[2] In general it is gradual in its approach, beginning with formication of the hands, and less frequently of the feet, and with more or less pain in the thumbs, elbows, knees, and feet, which also renders the movements of these parts imperfect. After a time the hands begin to tremble, and then the arms and lower limbs, the muscles of the lower jaw and the tongue, and, indeed all the muscles of animal life. The muscular contractions take place very rapidly, but by starts, so that great embarrassment is experienced in carrying food, and especially liquids, to the mouth. Walking is performed with difficulty, owing to irregular spasms of the muscles, and in going up or down stairs, the patient is often obliged to creep. Articulation is indistinct, and mastication difficult from a similar cause. As in chorea, all of these phenomena are augmented by mental emotion, while they generally cease if the patient lies down quietly or sleeps. In like manner they are appeased by alcoholic stimulants. In some cases, paralysis affects one or more groups of muscles. The phenomena of mercurial cachexia often coexist with those just described; and in many advanced cases, the respiration becomes labored, and mania, epilepsy, or other nervous diseases display themselves. Mercurial trembling is rarely cured when once fully developed.[3] The affection just described, although a striking illustration of the absorption of mercury by the system, is not, in reality, a more conclusive proof of this operation than the more customary effects of the medicine which will next be considered, or those other forms of mercurial cachexia which will afterwards be described.

Effects of Medicinal Doses.—On the Blood and the Secretions.—When blue mass, calomel, or either of the mild mercurial preparations, is taken in small but repeated doses, with a view of affecting the system, peculiar phenomena are developed. The first appreciable effect is usually an increased activity of the secretions, particularly of the intestinal canal, the discharges from which become liquid and bilious. The mucous membrane of the respiratory apparatus, and sometimes, also, of the genito-urinary organs, displays a

[1] Prager Vierteljahrs., lxii., Anal., 28. Consult also Ibid., lxxi., Anal., 26; and Ibid., lxxv., Anal., 27.

[2] Dict. des Sciences Méd., lv. 521.

[3] An interesting case of the disease treated by Sandras, with sulphurous baths and iron internally, is reported, Abeille Méd., x. 131. Others were treated by Dr. Barlow, Times and Gaz., Dec. 1853; and by Dr. Goolden, Lancet, Sept. 1853, p. 231.

similarly augmented secretion. If there happen to be anywhere an interstitial deposit of fibrin, or a collection of serum, its absorption is promoted. If the administration of the medicine is persisted in after the occurrence of these symptoms, others are developed of a more decidedly morbid character. The appetite fails, digestion is impaired, the secretions become still thinner and more copious, the firmness of the tissues diminishes, newly-formed callus is dissolved, and recently-healed wounds open afresh; the muscles waste, the skin has an earthy paleness, the eyelids and ankles become œdematous, and even general dropsy may ensue. These symptoms appear to depend upon the radical change which the blood has undergone by losing a large proportion of its normal solid constituents, and, perhaps, a portion of the vitality on which its coagulability in part depends. The unwonted fluidity of the blood predisposes to hemorrhage, which may become dangerous. Serious results from this cause are, it is true, of rare occurrence, yet one case is mentioned by Trousseau in which a man, who had been leeched and soon afterwards was salivated, experienced dangerous hemorrhage from the reopening of the leech-bites.[1] Not only do the secretions, as already stated, become thinner, but they also acquire new qualities; the breath is fetid, a peculiar metallic taste is perceived in the mouth, the saliva, as elsewhere shown, contains mercury, and traces of this substance exist also in the milk, and, in that case, it is very apt to derange the digestion of healthy children.[2] This mercurialization of the milk has been used therapeutically in cases of infantile syphilis.

Of all the usual effects of the full mercurial operation, salivation is the most striking. Immediately preceding it there is often an erethism of the system, in which, besides the increase of the secretions already noticed, or even before this takes place, the patient experiences loss of appetite, has a quick and frequent pulse, and manifests unwonted nervous excitability. If the salivation is profuse, this state may become strongly marked. The first evidence that the system is becoming mercurialized is shown by a metallic or copperish taste in the mouth and some soreness when the teeth are smartly struck together. The breath has, at the same time, a characteristic fetor. A red line may also be observed along the attachment of the gums to the teeth of the lower jaw. The redness extends gradually to the whole gingival surface and more or less to the cheeks, lips, tongue, and fauces; the tongue is coated with a whitish slime, has a sodden look, and bears upon its edges the imprint of the teeth. The salivary glands also become swollen and tender, and their secretion is augmented and of a ropy consistence, usually alkaline in its reaction, and of a penetrating taste and smell. Several pints of it may be discharged in the course of twenty-four hours. When mercurial salivation is excessive, these symptoms sometimes reach a distressing degree. The swelling of the mouth and tongue renders deglutition and speech difficult, if

[1] Traité de Thérapeutique, 5ème éd., i. 192. [2] RICHTER, op. cit., v. 314.

not impossible; extensive ulcers, sometimes coated with false membrane, attack the gums, cheeks, and fauces, and, in healing, may cause permanent adhesions of contiguous parts; œdema of the glottis may occur, the breath becomes insufferably fetid, the teeth loosen and fall out, and caries may attack the remaining teeth, and even the maxillary bones.

In some rare instances salivation recurs at remote periods from the original affection. Dr. Strong, of Boston, relates the case of a lady who, eighteen years before his report, was salivated in the month of October. The following February, while using Fowler's solution, she was again salivated, and thenceforth, although she took no more mercury except once by mistake, she had annually a recurrence of salivation in the same months as at first, but with gradually decreasing severity. In each attack the symptoms were perfectly well characterized.[1]

Although infants and young children are seldom salivated, certain exceptions to this rule must be admitted. Dr. J. B. Beck[2] collected a number of cases which prove the truth of this statement incontestably. Dr. Beck saw a child, five years of age, profusely salivated by five grains of calomel; Clarke met with three cases in children under three years of age; and Percival one, in which the effect was produced, in a child seven months old, by mercurial inunction. Champouillon reports the cases of two infants, the one eleven and the other twelve months old, who were actively salivated by fractional doses of calomel.[3] Canstatt mentions a boy ten years old, who was salivated by working at the trade of mirror silvering. Dr. Rush refers to seven instances of death from mercury given as a sialagogue to children between three and eight years of age.[4] Dr. S. Jackson (of Northumberland) saw three cases of children under seven years of age, in each of whom there was a loss of several teeth with their alveoli in consequence of calomel being given as a purge in remittent fever. In a fourth case, that of a child three years old, salivation was caused by the application of mercurial ointment to the face to prevent the pitting of confluent smallpox.[5] Dr. Blair met with a case of severe salivation from calomel in a boy ten years of age.[6]

It has been made a question whether mercurial salivation is not dependent upon the irritation of the gums and mucous membrane of the mouth, and that it sometimes is so has already been admitted, and illustrated by facts. No doubt, also, salivation usually follows various irritations of this membrane, such as arise from detention, decayed teeth, and variolous pustules within the cavity of the mouth. It is, perhaps, also true that a portion of the quickening influence attributed to mercury upon the secretion of the liver and the pancreas may be due to its irritation of the stomach

[1] Boston Med. and Surg. Journ., August, 1856, p. 439.
[2] Infant Therapeutics, p. 47.
[3] Times and Gaz., Sep. 1165, p. 253.
[4] Med. Obs. and Inquiries, 5th ed., ii. 143.
[5] Phila. Med. Exam., March, 1854, p. 131.
[6] Edinb. Journ., v. 136.

and duodenum. But that salivation is not necessarily dependent on any such reflected irritation is proved by the fact that medicines which do not affect the mouth sometimes occasion salivation, such, for example, as iodine, iodide of potassium, tartar emetic, arsenic, nitric acid, digitalis, and the preparations of copper. Indeed, mercury itself occasionally salivates without previously causing inflammation of the mouth. And when to this consideration it is added that mercury can be obtained from the saliva, bile, and pancreatic juice of persons or animals that have been salivated, no doubt can be entertained that salivation is due, almost, if not quite, exclusively, to the direct operation of the metal conveyed by the blood of these glands, or that the blood itself is so changed by its action as to produce the unwonted secretion referred to.

Besides salivation other evidences of the constitutional action of mercury call for notice. Some of these are usual, and, so to speak, normal effects, while others are more or less uncommon. Among the former it is desirable to note the following: The *digestive apparatus* is affected; the appetite is generally impaired; the tongue is coated; there is nausea with oppression, and sometimes pain or tenderness at the epigastrium; the bowels are loose, and occasionally the stools contain blood. These symptoms may follow mercurial inunction, as well as the internal use of mercury. Indeed, Oesterlen found metallic mercury in the intestine of a person who had used the medicine only by inunction.[1]

The *pancreas* would appear, in an especial manner, to be affected by mercury. Dieterich attributed the diarrhœa which it usually causes to an excessive secretion of this organ. Dr. Copland relates the case of a female who was excessively salivated for syphilis, after which she experienced deep-seated pain and heat at the epigastrium, with nausea, inappetence, thirst, and fever, and voided thin stools containing a fluid resembling saliva. After her death the pancreas, which weighed eight ounces, was red and congested, and its duct dilated.[2]

The power of mercury to increase the discharge of *bile* was for a long time unquestioned, although the mode in which it operates upon the liver was subject to discussion. According to some it renders the bile more liquid, and thus facilitates its secretion, and according to others it directly stimulates the secernent apparatus of the liver. It is not certain that it does either. As in the case of other organic stimulants, it sometimes may even cause the affection for which it is generally held to be the most certain cure. Thus Chapman regarded it as probable that "the inordinate use of this mineral may in various ways derange the primæ viæ and liver so as to produce icterose affections;"[3] and Cheyne states in as many words that mercurials actually produce jaundice.[4] Enlargement of the liver is more generally attributed to it. The green color of the

[1] CLARUS, Arzneimittellehre, p. 806.
[2] Am. Journ. of Med. Sci., April, 1846, p. 468.
[3] Ibid., p. 476. [4] Dublin Hosp. Rep., 1818.

stools after mercurial purges is usually ascribed to the presence of bile, and was incorrectly supposed to have been demonstrated by Michéa.[1] Green stools are not necessarily bilious. The dejections of infants often acquire this color from excessive acidity, as in ordinary cholera infantum. Dr. Golding Bird attributed the greenness to an altered condition of the coloring matter of the blood. Under the head of *Calomel* will be found further remarks on this subject.

On the *nervous system* the action of mercurials is decided. Few medicines produce such a marked sense of depression, both mental and bodily, as mercury, even in ordinary pugative doses, but when the system is brought thoroughly under its influence, these effects may become distressing. The susceptibility to external impressions, and particularly to that of cold, is augmented, pains in the limbs are felt, slight annoyances disturb the equanimity, and sometimes, it is said, mental debility and even loss of reason ensue.[2] It is alleged that these effects are traceable to a direct action of mercurials upon the nervous centres by means of which their fatty constituents are removed. This result is said to be most apt to proceed from mercurial inhalations. The latter statement appears probable; for all the more serious and permanent constitutional effects of mercury are found among those who are exposed to its vapors during its extraction from the ore or in its manufacture. This fact has been elsewhere illustrated.

Colson drew attention to the action of mercury upon the *uterus*.[3] In not a few instances it has occasioned menorrhagia or amenorrhœa, and in pregnant females miscarriage. From an extensive series of observations Lize concluded that the constitutional action of mercury upon a husband alone, or upon a wife alone, or upon both together, very commonly results in miscarriage, still-birth, or the premature death of the infant.[4]

Among the *circumstances modifying mercurial action* the following may be referred to: Some persons are so very susceptible to it that even the least dose of a mercurial medicine, or its application to the denuded cutis, will suffice to excite ptyalism. Canstatt met with a case in which it was produced by three grains of calomel. We have seen this effect occasioned by the application of nitrate of mercury to an ulcer upon the arm. On the other hand, numerous cases have occurred of persons who appear to be quite insusceptible of mercurial salivation. Trousseau refers to a female affected with constitutional syphilis, and who was treated by various preparations of mercury, including frictions with the ointment, baths containing corrosive sublimate, and the internal use of the iodide of mercury, and who nevertheless experienced no sensible effects from them, except a diarrhœa. In general, females are more susceptible

[1] Monthly Retrospect, Dec. 1848.
[2] Lauvergne (L'Agonie et la Mort, i. 416) asserts that he has known mental imbecility to be produced by an excessive and injudicious use of mercurials.
[3] Archives Gén., xviii. 24.
[4] Prager Vierteljahrs., xcvii. Anal., p. 26.

than males to the constitutional influence of mercury, and as has already been shown, adults are more so than children. All diseases or stages of disease in which the powers of life are greatly prostrated, lessen or prevent this action of the medicine. This is strikingly illustrated in malignant cholera. In that affection mercurials given during the stage of collapse appear to remain in the primæ viæ wholly unchanged, and sometimes, when reaction has taken place, alarming and even fatal mercurialism has ensued. In typhus and in typhoid fever of a grave type, in typhoid forms of disease, generally, in meningeal affections and in apoplexy, it is difficult to establish mercurialism. A very common, but mischievous error, is to suppose that the revival of the functions from their state of embarrassment and oppression is due to the salivation which occurs at the same time. Much more frequently the course of the disease, in liberating the system from its lethargy of function, permits the absorption of the medicine and the development of its specific effects, which then become superfluous, if not actually hurtful.

The more unusual and strictly morbid effects of mercury, or such, at least, as are the most important, will next be considered. And here it may be repeated that of the several modes by which mercury is made to enter the body, inhalation most speedily produces the specific influence of the medicine, and next in order, inunction is most prompt in its effects; but the stomach is the most appropriate channel of introduction for the dry and liquid mercurial preparations.

1. *Mercurial Fever.*—This febrile condition usually arises between the fifteenth and the twentieth days of the treatment by inunction, and commonly precedes salivation, and a specific eruption on the skin. It has the characters of an irritative oftener than of a continued fever. There is a complaint of weariness and chilliness; the pulse is frequent, the tongue coated, the tendency to perspire very great, and sometimes the sensibility of the skin is such that the patient is readily chilled, and may even perish from nervous apoplexy. Simultaneously with these symptoms there is usually an intolerable sense of constriction in the stomach, nausea, sometimes vomiting, but not frequently, colic, and either diarrhœa or constipation. The duration of this fever is generally from three to seven days, but it may last for several weeks. It terminates on the occurrence of salivation, by the specific rash presently to be described, or by sweating.[1]

2. *Morbid Action on the Skin. Eczema Mercuriale.*—The continued use of mercurial frictions irritates the skin, inducing at first redness and tenderness, and afterwards, in some cases, a peculiar eruption, erysipelas, or even fatal gangrene. The cutaneous eruption excited by mercury was first, it is believed, mentioned by Benjamin Bell, who says: "It is not an uncommon effect of mercury to excite an eruption upon the surface of the body. In some this appears as a miliary rash, somewhat resembling measles; while, in others, it is considerably elevated, and seems to be produced by

[1] CANSTATT, Med. Klinik, 2te Aufl., ii. 794.

a serous effusion between the cutis and the scarf skin. In some the eruption is partial, while in others, it prevails generally over the whole body." It was also described by Dr. Speers, of Edinburgh,[1] by Dr. Moriarty, and by Mr. Alley, of Dublin, who has given the fullest account of its course and varieties.[2] In its mildest form this affection consists of innumerable minute and transparent vesicles, on a light rose-colored efflorescence, occupying a large portion of the skin. It is accompanied with a prickling sensation and itching, but not with fever. A severer and febrile form presents an efflorescence somewhat like that of rubeola, and in a third form, which Mr. Alley styled malignant, there is fever, an intense burning heat of the skin, and extreme soreness of the fauces; the vesicles are of a large size, and the spots of a dark and even purplish color. In this form, when the vesicles burst, crusts are formed of a very unsightly and disgusting appearance. The second form here alluded to has been observed by Baron at the Children's Hospital of Paris, and was produced by mercurial frictions. The eruption was most abundant everywhere else than upon the places where the frictions had been made; it occasioned neither itching nor smarting, nor was it accompanied by ptyalism. A slight degree of fever was observed during a period of from three to six days, during which the eruption lasted.[3]

In some cases of mercurial cachexia, an eruption of rupia and also of pustules (ecthyma?) has been met with.

3. *Ulceration.*—Besides the tendency of ulcers, on any part of the body, to assume an unhealthy appearance, and even to become gangrenous, and of contiguous portions of the cutis, *e. g.*, of the buttocks, the thighs, etc., to suffer excoriation, the constitutional action of mercury may develop ulcers in the buccal cavity, upon the gums, the inner surface of the lips and cheeks, and the tongue, generally attended with salivation. These ulcers usually advance from within outwards, raising and then casting off the epithelium, and exposing a red and irritable surface which secretes an acrid fluid. They are irregular in shape, without defined edges, bleed readily, have a dirty whitish surface, are surrounded with a dark halo, and are apt to run together. Syphilitic ulcers, on the contrary, are more frequently circular, attack the posterior rather than the anterior portion of the mouth, present defined margins, with a copperish hue of the surrounding membrane, and are not apt to extend from the primary seat. It is true that under the action of mercury syphilitic ulcers may lose their characteristic appearance, and render the diagnosis doubtful, but in that case fresh ulcers form, with all the peculiarities of the mercurial sort.[4] These may be also attributed to a scorbutic taint, but the circumstances of their origin should prevent this error, and also the mercurial fetor

[1] Edinb. Med. and Surg. Journ., 1805, i. 7.
[2] Observations on the Hydrargyria, 1810.
[3] Bull. de Thérap., xxxviii. 184.
[4] Handbuch der Speciel. Pathol. u. Therap., by FALCK, VIRCHOW, and SIMON, ii. 123.

exhaled by the breath. It occasionally happens that hemorrhage, which, indeed, has in some instances proved fatal, is produced by mercurial ulceration of the fauces.[1] Death may also result from a destruction of the soft parts. A case is reported by Drs. Graves and Stokes[2] of a child, eleven years of age, who, for an inflammation of the trachea, took eight grains of calomel in divided doses. Salivation followed, with excessive swelling of the face and neck; ulcers beginning at the corners of the mouth spread to the lips and cheeks, causing an extensive destruction of both; a sloughing ulcer formed on the palate, and the fetor of the breath was excessive. Treatment was unavailing, and death took place on the eighth day. That form of ulceration of the mouth known as *gangrœnopsis* usually arises during a state of exhaustion of the system following disease, especially eruptive fevers and dysentery; the ulcers are of a circumscribed character, generally of the cheek, and follow tumefaction and hardness of the part. The affection known as *cancrum oris*, and proceeding from the same causes as the one last mentioned, begins in the gums, and presents symptoms closely resembling mercurial sore mouth, including salivation, swelling of the submaxillary glands, swollen, spongy, bleeding, and ulcerated gums, covered with a pultaceous deposit, with loosening and even loss of the teeth.[3] If such a state ensues upon the administration of mercury, there appears to be nothing by which it can be distinguished from the effects of this medicine, unless it be the existence of a fetid odor, which is different from that occasioned by mercury.

4. *Salivation.*—The principal morbid phenomena of this process have already been described.

5. *Mercurial Purging.*—This is not the direct effect of purgative doses of mercury, but is an affection in which, during the constitutional operation of the medicine, the alvine evacuations become at first feculent, thin, and greenish, and afterwards watery or frothy, and pale in color. There may be ten or fifteen of such stools in the course of twenty-four hours. At the same time there is a sense of fulness in the abdomen, tenderness on pressure in the epigastrium, and a dull, tensive pain in the same region. The thirst is great, the mouth and skin dry, and the urine scanty. As the diarrhœa augments, vomiting may be superadded, while the skin grows cool and the eyes are sunken and dark. The affection may terminate in gastric inflammation. Its symptoms are by some attributed to an excessive action of the pancreas, which, as elsewhere stated, is sometimes found diseased.[4]

6. *Affections of the Bones.*—It has long been a question, and is one not yet fully determined, how far mercury may operate to produce disease of the bones. The tendency of syphilis to develop these affections is well known, and also the great frequency of their occurrence in syphilitic cases treated by mercury, yet it is certain

[1] Lancet, 1843–44, i. 277. [2] Dublin Hosp. Reports, iv. 299.
[3] WEST, Dis. of Infancy and Childhood, 3d ed., p. 431.
[4] FALCK, loc. cit.

that they sometimes follow the administration of this medicine in cases wholly free from a syphilitic taint. Mercurial nodes, it is said, precede the ulcers, and the destruction of tissue proceeds from without inwards. They most frequently are seated in the spongy bones of the base of the cranium, or in the ends of the long bones. (*Canstatt.*)

Mr. Spence reports the case of an old woman who had never been affected with syphilis, but had taken large quantities of mercury. After suffering from pains in the head, ulceration began in the soft parts over the os frontis, involving the bone and dura mater, and ultimately exposing the brain. After death an abscess was found in the substance of the brain.[1]

7. *Affections of the Nervous System.*—Pains in the head and limbs, which partake both of a rheumatic and a neuralgic character, are frequently produced by mercurial saturation of the economy, particularly in cases of trembling due to this agent. In other cases, the senses are morbidly excited, or the perceptions are perverted; a moody melancholy and fear of death may overtake the patient, who may sink into dementia; or, more rarely, insanity of a maniacal form may be developed. In a few cases, epilepsy results. The trembling palsy due to mercury has been already described. In connection with, or independently of it, paralysis may affect the limbs, involving only the upper or the lower limbs, or both at once, and affecting the flexor as well as the extensor muscles.[2] The same affection sometimes involves the laryngeal muscles, producing aphonia.

8. *Mercurial Anæmia* (*Erethismus Mercurialis*).—This affection is generally independent of salivation. It is distinguished by the chlorotic aspect of the patient, a sense of oppressed breathing, tumultuous palpitation of the heart, a small, frequent, and sometimes intermitting pulse, a tendency to syncope, general susceptibility to cold, and great debility. Death is often owing to syncope on the patient's making a sudden or unusual exertion.

9. *Mercurial Cachexia.*—The action of mercury on the blood, by which it tends to reduce the proportion of solid materials in this fluid, and thus to impair the nutrition of the organs, is capable, when carried beyond moderate bounds, of occasioning a form of artificial scurvy, some of the elements of which have previously been described. The muscles lose their firmness, fulness, and power, the complexion assumes a pallid or an earthy hue, the breath becomes fetid, the urine is readily decomposed, and diarrhœa is usually present. The gums grow spongy, the hair falls out, dull pains in the bones and joints are felt; œdema of the ankles, or even general dropsy, may form; hemorrhage from the nose, bowels, kidneys, or reopened wounds takes place, and hectic fever, with tubercular consumption, may terminate life.

Treatment of the Effects of Mercury.—Whatever may be the form of disease engendered, the patient should immediately abstain from

[1] Edinb. Med. Journ., ii. 855. [2] Archives Gén., Sept. 1863, p. 359.

the further use of mercury, and an attempt should be made by means of saline laxatives, by diaphoretics, and by iodide of potassium, to hasten the elimination of the poison from his system. According to his febrile or his cachectic state, a cooling vegetable regimen, or a tonic and nutritious one, with iron as a medicine, should be prescribed. Great care should be exercised in protecting him from cold and dampness. The mercurial inflammation of the mouth may be treated by a great variety of local applications, such as mucilaginous washes with the addition of some preparation of opium, and, when its intensity is to some extent abated, astringent decoctions and infusions may be employed, or a solution of gallic acid. A more efficient application is hydrochloric acid applied with a camel's hair brush to the ulcerated surfaces, and immediately removed by washing the mouth with water in order to save the teeth from harm. Iodine in solution, creasote, alum, and nitrate of silver have been used in the same way. Internally acetate of lead and opium, iodide of potassium, and chlorate of potassa have been given, and of these the last is the most efficacious in this manner as well as locally.

Action of Calomel. *On Animals.*—Its operation on animals does not differ from its action upon man. In large doses it occasions some depression and debility with copious purging. Some further details are given below.

On Man.—Ledelius saw a case in which death resulted within twenty-four hours after half an ounce of calomel had been taken. The symptoms were vomiting and purging. In another instance, a female took fourteen drachms of calomel at a dose. Cholera morbus ensued, but subsided under the use of oily and mucilaginous liquids. Two days afterwards salivation occurred, but by the end of three weeks the effects of the medicine had ceased.[1] Besides these, enough fatal cases are on record to prove that this preparation of mercury sometimes acts as an irritant poison. Many also demonstrate the peculiar virulence of salivation induced by its means.

The variable effects which are produced by calomel have been explained by the variable quantity of alkaline chlorides existing in the stomach, upon which the solubility and absorption of the medicine are supposed to depend. However the fact may be accounted for, it is established that both of the poisonous effects described occasionally result from doses of calomel which ordinarily are innocuous. Sometimes this peculiarity appears to arise from the action upon the calomel of common salt (chloride of sodium), taken with the food, and here, doubtless, the long continuance of the compound in the bowels would tend to develop its poisonous qualities. Hence, probably, the ordinary caution against using salt with the food after mercury, and the usual prescription of a laxative to be taken a few hours after calomel, when the constitutional action of the latter is not desired. Sometimes the chloride of ammonium appears

[1] WIBMER, op. cit., iii. 72.

to have been the agent in converting the medicine into a poison. A case is recorded in which a child was killed by taking several powders which contained this salt mixed with calomel.[1] Some further remarks upon this subject will be found below.

Chota Ram, a delicate lad of fourteen, affected with malarial fever, took *three* grains of calomel with eight of colocynth, and the next morning a drachm of compound jalap powder, by which he was freely purged. Two days afterwards the same doses were repeated, and, after a similar interval, the patient was attacked with all the symptoms of mercurial sore mouth, except salivation; these were followed by ulceration, grangrene, and death fifteen days after the first dose of mercury was administered.[2]

In contrast to the more or less mischievous effects of calomel in large and in small doses, might be mentioned a number in which enormous quantities have been swallowed without producing serious symptoms. The most familiar illustration of this statement is the custom, not long since prevalent in certain portions of the United States, of administering the medicine by teaspoonfuls. It was for the most part, passed by stool and without salivating. In such cases may it not be possible that the undissolved portions of the calomel absorb and retain the greater part of what is rendered soluble by the gastric acids? The fact that large doses of calomel are given in cholera without effect, at least until reaction occurs, seems to be explicable on the supposition, partly, that the stomach contains but little acid, and partly that its absorbent faculty is suspended during the excessive aqueous secretion from the gastric mucous membrane.

The views which for the last twenty or thirty years have prevailed respecting the action of calomel and the indications for its use, are clearly traceable to the writings of Johnson and Annesley. The latter in imitation of the former, from whom he derived the notion, endeavored to prove that when the use of calomel is indicated it is most beneficial in large doses, and in maintaining this theory and practice he sheltered himself, in part, by the authority of Horstius, Sylvius, Wepfer, Freind, Geoffroy, and others.[3] He, however, insisted that such doses should not be repeated at short intervals, and he combated the doctrine that the object in view is to make the mouth sore. He maintained that while small doses of from two to six grains will purge, and keep up an irritation of the stomach and bowels, twenty grains will do neither, but, on the contrary, allay the intestinal irritability which may be present as an effect of inflammation of the bowels and liver. In order, as he supposed, to base his practice securely, in 1823 he gave large doses (60 to 180 grains) of calomel to dogs, and concluded, from his experiments, that the medicine had the effect of *diminishing* the vascularity of the intestinal mucous membrane, and thus became antiphlogistic in its operation. From other experiments upon the dead

[1] Journ. de Pharm., Feb. 1840. [2] CAMPBELL, Lond. Med. Gaz., xviii. 484.
[3] Diseases of India, p. 377.

human subject he inferred that an effect of the medicine is also to dilute the tenacious mucus covering the gastro-intestinal surface. The latter operation he conceived to be an efficient cause of the cholagogue action of mercury; for he supposed the medicine to dissolve the inspissated mucus which (hypothetically) obstructed the gall-ducts, and thus come into more immediate contact with the mucous membrane of the duodenum, and exert upon it an influence which "was propagated thence along the canals of the ducts to the gall-bladder and the liver itself." Small doses of mercury, on the other hand, he held to be absorbed and to promote the secretion of bile, causing thereby distension of the gall-bladder with accumulated bile, unless the inspissated mucus were at the same time removed by purgative doses of the medicine.

This view of the cholagogue action of mercury has been generally accepted and become as thoroughly a part of the current medical doctrine as if it were a demonstrable physical result. Yet a portion of it appears to be hypothetical, and the remainder untrue. The latter term applies to the results of Annesley's experiments, which have been completely set aside by the more thorough investigations of Mr. Murray, in 1841.[1] He found that calomel, given to dogs in doses of from five to thirty grains, and thence to 120 or 180 grains, produced *increased* gastro-intestinal vascularity, and the larger doses sanguineous effusion. At the same time, however, an increased flow of bile, mucus, and serum took place. But the experiments of Dr. George Scott upon dogs threw considerable doubt upon the generally received opinion, that calomel in large and purgative doses increases the flow of bile.[2] He found a diminution in the amount of fluid bile and bile solids secreted after the administration of large doses of calomel. Mosler also, from his careful and ingenuous investigations, in which repeated *small* doses of calomel were administered to dogs,[3] concluded that the medicine does not augment the secretion of bile. The most careful analysis of this secretion, moreover, did not reveal a trace of the presence of mercury in the animals that were taking it and visibly suffering from its toxical operation. The experiments of Dr. C. H. Jones[4] appear to show that mercury produces very great congestion of the liver, and increases the production of yellow matter in the cells of the liver, but not that it in any degree operates as an emulgent of the bile.

Most of what has been done to throw light upon this subject must be dated from the experiments just referred to, and from the observations of Dr. Inman, of Liverpool. After having shown that the extremely fetid smell of certain fæces is due, not to their "vitiation," but to their rapid putrefaction, in certain states of the economy,[5] he and Dr. Thudicum[6] after him have shown that calomel generally diminishes the quantity of bile secreted, especially when it acts as a purgative. Dr. Inman maintained (and, although Buch-

[1] MOREHEAD, Disease in India, i. 222.
[2] Archives of Medicine, No. iii. p. 224.
[3] VIRCHOW'S Archiv, xiii. 41.
[4] Med.-Chir. Trans., xxxv. 258.
[5] RANKING'S Abs. (Am. ed.), xxx. 264.
[6] Lancet, Oct. 1860, p. 411.

heim and others have taken the opposite view, we believe the statement to be correct), that the green color of "calomel stools," which is generally attributed to bile, is really owing to the presence of subsulphide of mercury, and that they contain less instead of more than the usual proportion of biliary matter. It is to the mercurial salt and not to bile that scalding of the anus is due after purgation by calomel. It appears, further, that the brown color of fæces contained in the colon is not owing to bile, because such fæces actually yield on analysis less bile than those taken from the small intestine, which, nevertheless, are of a very light color. Moreover, although a suspended secretion of bile is generally accompanied with colorless stools, such is not invariably the case, for Dr. Inman refers to several cases of total suppression of bile in which the stools were brown. He concludes from these and other considerations that the characteristic color of fæces is owing not to bile, but to a secretion which takes place in the colon.[1] Dr. Thudicum, also, pronounces this positive judgment: "Calomel is not a cholagogue, but diminishes the secretion of bile."[2]

Since 1868, the question as to the action of mercury upon the liver has been the subject of various opinions, of painstaking investigations, and critical examinations, which have advanced our knowledge of the subject and rendered it more precise. In regard to opinions, two may be briefly stated as representatives of classes. Dr. A. C. Macleod asserts that "calomel in small doses acts on the bowels; in large doses on the liver." . . . . "The liver is the organ *electively* and exclusively acted upon" by large doses.[3] Dr. T. K. Chambers, on the other hand, says "there is a very curious superstition about the use of mercurial purgatives. . . . They are supposed to do good by 'acting on the liver' whether the liver is acting too little or too much . . . All that mercury can be really sure to effect on the hepatic function is a poisoning of the bile, so as to prevent its absorption by the ileum, and to cause it to be rejected in a liquid form *per anum;* and that is a very doubtful advantage in most cases."[4] And Dr. Murchison remarks, "there is no evidence that mercurials stimulate the liver to increased secretion. If they did they would be injurious rather than otherwise in cases of jaundice from hepatic congestion."[5]

In 1868, Dr. J. Hughes Bennett presented "The Report of the Edinburgh Committee on the Action of Mercury on the Biliary Secretion," in which the following conclusion was announced: "We have seen that in whatever form or dose it may be given it utterly fails to stimulate the liver. Its constitutional action has been excited slowly and rapidly by means of corrosive sublimate with a like result. In poisonous doses it produces a marked diminution of the flow of bile. . . . In all these varied attempts, carefully repeated, under every varying circumstance that could be

[1] BRAITHWAITE's Retros. (Am. ed.), xliii. 59; xlv. 86.
[2] A Treatise on Gall-Stones (1863), p. 292.
[3] Acholic Diseases, p. 82.
[4] The Indigestions (Am. ed.), p. 112.
[5] Clinical Lectures on Diseases of the Liver, p. 404.

thought of, no evidence was obtained that mercury acted specially on the liver at all. The exact measurement of all the bile secreted in eight dogs, first without and then with mercury, tends rather to show, that so far from increasing the flow of bile, it causes its diminution, through its general depressing action on the entire organism." But, it having been suggested that mercurials may stimulate the secretion of bile "by acting on the orifice of the common bile-duct," Dr. Bennett performed experiments upon cats and dogs which led him to conclude "that mercurial preparations digested in the stomach do not irritate the orifice of the common duct in the duodenum, or induce any flow of bile into it."[1] Dr. Thomas R. Fraser, who had been a member of the committee, whose investigations Dr. Bennett reported, was unwilling to accept the conclusions which have been stated, and published a paper upon this subject,[2] in which all the questions bearing upon it are elaborately discussed from a clinical as well as an experimental standpoint, and the conclusion is reached that mercury "undoubtedly exerts a cholagogue action, in so far, that by its influence the flow of bile into the intestinal canal may be increased," and "that there exists some evidence in favor of the doctrines which imply that mercury may increase the formation of bile by a direct and indirect action on the liver, and also by an action in virtue of which various abnormal conditions that interfere with the secreting function of this organ are removed." He also suggests too very important criticisms upon the method pursued by the Edinburgh Committee: 1. That their experiments "were performed in such a manner that an action on *the secreting activity of the liver cells*—not on the flow of bile into the intestines—*could alone be examined;*" and, 2. That "the injurious effects on digestion and assimilation, which follow the prevention of the entrance of bile into the intestines, were necessarily present in all the experiments," since they prevented the action of the bile (which is not an excretion, but a secretion) in maintaining the healthy condition of the subjects of their experiments. For, as Schiff has shown, if the common duct is tied in dogs, and all the bile secreted is conveyed away through a fistulous opening in the gall-bladder, the amount of that secretion, after a temporary increase, is permanently diminished, because the absorption of bile from the intestine is soon arrested. For under these circumstances, if bile was introduced into the stomach, the duodenum, the areolar tissue, or the veins, the flow of bile from the liver was at once increased. Dr. T. Lauder Brunton,[3] in the light of these experiments, and assuming that mercury acts as a purgative on the upper part of the intestine, contends that by carrying forward the bile it prevents its reabsorption, and thereby tends to relieve all those conditions of the system in which there is too much bile in the blood or in the liver, or in both at once. It not only diminished the quantity which has to be secreted by the liver, but it likewise lessens the formation of bile. This theory is plausible in

[1] British Med. Journ., Jan. 1871, p. 1. [2] Edinb. Med. Journ., xvi. 904.
[3] Reprint from British Med. Journ., Jan. 1873, p. 15.

its application to cases of "biliousness" and excessive secretion of bile; but it throws no light upon those much more numerous cases in which the secretion of the liver is deficient, and in which mercury is held to be the appropriate remedy, unless it is assumed that this medicine is *alone* endowed with the faculty of stimulating the duodenum, an assumption which there is nothing to warrant.

Calomel, even in small doses, will sometimes occasion symptoms resembling those already ascribed to the prolonged and toxical action of the medicine. It has been described as a state of morbid sensibility; a hysteric feeling which, with the shedding of tears, the yawning, and the sensation of cold that accompanies it, is singularly distressing. But cheerfulness and the accustomed serenity are restored as soon as the action of the medicine has ceased.[1]

The systematic use of minute doses of calomel, for the purpose of producing its constitutional effects, was brought to notice by Dr. Law, of Dublin,[2] in 1839. By giving one-twelfth of a grain every hour, he found that salivation was frequently produced before two or three grains of the medicine had been taken, and that four grains were seldom required to produce that effect. These experiments were repeated at the Hôpital Necker, in Paris, by Trousseau, and with identical results.[3] It is stated that the influence of the remedy was generally manifested in from twenty-four to sixty hours, and in some cases the gums became distinctly affected after eight doses containing one twenty-fourth of a grain each. When its administration was suspended, and after an interval renewed, the effects were less decided, or did not manifest themselves at all. The subdivision of the medicine manifestly quickened its operation. For example, a given quantity divided into twelve doses, and administered at intervals of two hours, produced less effect than when divided into twenty-four parts, and given every hour. The earliest signs of its operation were usually nausea, colic, borborygmi, and greenish liquid stools, which, however, did not impair the constitutional action of the medicine. Its operation on the mouth consisted of the usual metallic taste and pasty sensation, soreness when the teeth were struck together, a white line along the dental attachment of the gums, and the redness and swelling of these parts. The flow of the saliva was rarely profuse.

These facts lend some color to the more recent theory that blue mass or calomel is operative in so far only as it is susceptible of solution by the acid contents of the stomach. Cases have repeatedly presented themselves in which salivation has ensued upon the administration of a very small dose of mercury, and Dr. Snow first suggested that this might be owing to an accidental excess of acid in the stomach. He several times observed that salivation followed when a small quantity of blue pill or calomel was taken at the same time with a mixture containing sulphuric acid; and he supposed that if the stomach held an excess of hydrochloric acid,

[1] Journ. of Psychological Med., i. 295. [2] Dublin Quart. Journ., xiv. 393.
[3] Duclos, Bull. de Thérap., xxxi. 17, 85.

it might convert the milder preparation of mercury into a bichloride.[1] An analogous view has more recently been put forth by Mialhe.[2] He maintains that all of the medical properties of calomel are owing to its partial transformation into corrosive sublimate in the stomach. He admits, however, that the chlorides contained in the gastric juice, and to which he attributes this transformation, are never abundant enough to generate a poisonous dose of the bichloride, however large a quantity of calomel may be present. Even with a higher temperature than that of the stomach he was unable to procure more than one-sixteenth of a grain (15 milligrammes, or 0.06310 Troy gr.). Indeed, Bucheim, Oetinger, and Winckler claim to have shown that the transformation in question does not occur at all at the temperature of the body.[3] In addition to all of the considerations growing out of these facts, it should not be forgotten that of the three preparations of mercury especially referred to in this paragraph, corrosive sublimate is that one precisely which is least apt to produce salivation. It is stated by Mr. Clay, of Manchester, that after a long and very extensive experience of its use, both in adults and children, he "scarcely, *if ever*, saw a decided case of ptyalism from the exhibition of the bichloride alone."[4] Quite recently Kämmerer claims to have demonstrated that when calomel is applied to an ulcer of the cornea it is partially converted into corrosive sublimate which is absorbed by the conjunctiva and at the same time acts chemically, and in no wise mechanically on the tissues of the eye.[5] These contradictory conclusions, which are met with at every step in the history of experimental medical science, are well adapted to console physicians for the uncertainties which are inherent in medical art.

Action of Corrosive Sublimate. *On Plants and Animals.*—Bouchardat found that plants are poisoned by solutions containing a thousandth part of the bichloride of mercury, and that leeches and fish are immediately affected and die in a few minutes when immersed in such a solution. He dissolved one-sixth of a grain of the iodide of mercury in a quart (1000 grammes) of water, and placed in it four small fish. Within two hours two of them died, and the others also perished by the close of the day. Yet the proportion of the salt was so small that it could not be detected by the usual chemical reagents.[6]

A solution of the former salt injected into the veins of a dog produces signs of extreme suffering, followed speedily by death. When introduced freely into the cellular tissue of the thigh, the animal was affected with dulness, loss of appetite, and sometimes vomiting or bloody diarrhœa, with general depression and ultimately death. Congestion and even inflammation of the gastro-intestinal mucous membrane were frequently, although not always, found on dissection, and there was generally fluidity of the blood. When a smaller

[1] Lancet, Jan. 1840, p. 625. [2] Chimie Appliquée, p. 407.
[3] OESTERLEN, Heilmittellehre, p. 102. [4] Lancet, Aug. 1841, p. 752.
[5] VIRCHOW'S Archiv (1874), 5th ser., ix. 468.
[6] Annuaire de Thérap., 1846, p. 266.

quantity of the salt is used, symptoms of the same nature, but of less severity, occur, with salivation and intense thirst. After death, besides the lesions mentioned, the lungs and other vascular organs are deeply congested, and are sometimes the seat of a bloody extravasation.[1]

When introduced into the stomach of dogs, corrosive sublimate occasions pain, thirst, violent straining, and vomiting of mucous and bloody matters. If the dose has been large, death takes place speedily, and in most cases with convulsions; under opposite circumstances, the animal perishes gradually by exhaustion. The resulting lesions depend upon the quantity of the poison employed, and the duration of life after it has been administered, and hence may vary from a trifling vascular injection to a state of softening of the gastric mucous membrane. These alterations may also, to some extent, involve the intestine, and the rectum in particular. Many years ago, Brodie inferred from his experiments that corrosive sublimate, when taken internally in large quantities, occasions death by acting chemically on the mucous membrane of the stomach so as to destroy its texture.[2] Orfila came to a like conclusion, adding, however, that the poison acts upon the heart.[3] These conclusions are accepted almost universally as true; yet it is proper to state that Giacomini declares he never saw, in his experiments upon rabbits and dogs, the mucous membrane of the stomach inflamed or ulcerated by this substance; but, on the contrary, pale. If any alteration of tissue is found, it is, he asserts, cadaveric.[4] There is reason to believe that attachment to a system blinded this eminent physician to lesions which were very visible to other observers.

On Man. Externally.—Examples are numerous of poisoning by the external application of corrosive sublimate. Many are collected by Wibmer. In one of these a lady applied a solution of the salt to a swelling on the leg, resulting from a bruise. It inflamed the part violently, and produced salivation, vomiting, swelling of the throat, and pain along the œsophagus. In four other cases death resulted from applying a solution of corrosive sublimate to denuded or ulcerated surfaces. Similar examples are furnished by Orfila and others. One of these is striking. Jules Cloquet, the eminent surgeon and obstetrician, in removing some anatomical specimens from a solution of corrosive sublimate in which they were preserved, wet his hands several times with the liquid, and neglected washing them afterwards. In about eight hours, in the middle of the night, he awoke with violent pains at the pit of the stomach, which was also very tender. The pain extended to the back, with constriction of the chest, a small, irregular pulse, thirst, retching, and vomiting of acrid fluid with a metallic taste. Although these symptoms subsided in the course of the day, the epigastrium remained tender for a week.[5] An extraordinary instance of the

[1] WIBMER, op. cit.
[2] Physiological Researches, p. 102.
[3] Toxicologie, i. 677.
[4] Mat. Méd., p. 427.
[5] Toxicologie, i. 671.

orption of this substance is the following. A gentleman rubbed five grains of corrosive sublimate mixed with butter upon the integuments of his genital organs and the neighboring parts. Violent inflammation ensued, which, however, subsided by the next day. Several days afterwards a gold ring upon the gentleman's hand, several gold coins in his pocket, and other articles of gold in contact with his skin, were found to be plated with quicksilver. There was, however, no swelling of the gums, nor other sign of mercurialization.[1] Two children, affected with favus of the scalp, were treated with an ointment containing one hundred and twenty grains of corrosive sublimate to an ounce of fat. Extreme suffering ensued, with delirium, vomiting, and bloody stools, and both patients died, the one in seven, the other in nine days.[2] In another case all the symptoms of poisoning by corrosive sublimate, and subsequently mercurial salivation, were produced by injecting into the vagina twenty grains of this substance dissolved in an ounce of lime-water.[3] For other cases analogous to these the reader is referred to "Taylor on Poisons." Isambert has called attention to the irritant action of some mercurial compounds formed by the successive or conjoint application of their constituents to the skin. A patient who had been using frictions of mercurial ointment on the scrotum afterwards employed one containing iodide of potassium; a burning pain with vivid redness and great swelling ensued, in one case, and in another vesication. In a third case a woman who had had an ointment of biniodide of mercury and iodide of potassium applied to a herpetic eruption, took a sulphur bath, whereupon she cried out on account of the severe burning pain produced in the eruption by the bath. The patches looked as if they had been burned.[4]

When small doses of corrosive sublimate are continued until their poisonous action is developed, the following symptoms are observed: Burning and colicky pains in the stomach and bowels, nausea, vomiting, diarrhœa, and in some cases, but not as the usual effect of this salt, salivation, and the evidences of general mercurial poisoning already described. Larger and directly poisonous doses produce constriction, and a severe burning pain in the fauces, œsophagus, and stomach, with retching and the vomiting first of mucus and then of bile and blood. The pain diffuses itself throughout the abdomen, which is very sensitive to pressure, and sometimes bloody stools are voided, with tenesmus. At the same time there is great restlessness, an injected countenance, and intense thirst, and subsequently a quick, frequent, and small pulse, with labored breathing, cold sweating, a clammy skin, and suppression or scantiness of urine. In fatal cases death may occur within a few hours after the ingestion of the poison, or may be delayed for several weeks. Should recovery take place, the stomach and bowels may still remain morbidly irritable for a long time. The lesions produced by the poison are these: The stomach is contracted,

[1] Lancet, Oct. 1830, p. 137.
[2] Dublin Quart. Journ., Aug. 1854.
[3] Ibid., Feb. 1856, p. 242.
[4] Bull. de Thér., lxxii. 488.

its mucous membrane, that of the œsophagus, and even of the small intestine, is generally but not always reddened in patches, or is the seat of ulcers of a dark color, and with ragged edges. A large dose sometimes converts the gastric mucous membrane into a soft, grayish pulp. The bladder contains but little urine.

Action of Red Oxide of Mercury. *On Animals.*—Ten grains of this substance were given by Hillefeld to a young rabbit. No violent symptoms ensued, but the animal was purged, seemed exhausted, and died within twenty-four hours. Vascular injection and ulcers of the stomach were found on dissection. Orfila's experiments furnished very similar results. In both instances the depressing effects of the poison were remarkable.

On Man.—In many cases the constitutional effects of mercury have been produced by the external application of this compound. Several of these are furnished by Hunter in his Treatise on the Cure of Lues Venerea. In one, an ointment of red precipitate was applied to a granulating stump, in another, to an ulcer of the leg, and in a third, to a sore on the trunk resulting from a burn. Internally, this mercurial acts as an irritant, occasioning cramps and burning pain in the stomach and bowels, with vomiting and purging, cold sweats, general weakness, and death. The lesions of the gastro-intestinal mucous membrane are inflammation and even corrosion.

Action of the Red Sulphuret.—Applied to a wound in a dog's thigh, it proved fatal after several days, and the stomach was ulcerated. (*Smith.*) Orfila, however, found no effects from large doses of it administered to animals. Its vapor appears to be capable of salivating.

Action of White Precipitate.—The operation of ammoniated mercury is said to be analogous to that of the bichloride, but much less energetic than the action of that salt. A woman swallowed nearly a heaped teaspoonful of ammoniated mercury in a mistake for magnesia. Extreme nausea with violent vomiting and purging ensued. These symptoms continued for twelve hours; but there was no tenderness or burning at the epigastrium, and on the third day all unpleasant feelings had disappeared.[1] In London it is said that cases frequently happen in which one or two drachms of this substance are taken for suicidal purposes, and that beyond slight gastric uneasiness no particular symptoms occur.[2] Yet it would seem to have produced death by salivation in one case quoted by Taylor, and in another (occurring in a child affected with chronic gastro-intestinal disorder) the combined irritant and depressing effects of a corrosive poison.[3]

Action of the Iodides of Mercury.—These preparations resemble calomel and corrosive sublimate, respectively, in their effects, but are less powerful. The biniodide is more active than

[1] Chapman, Amer. Med. Times, Aug. 1864, p. 78.
[2] Times and Gaz., Oct. 1864, p. 385.
[3] Guy's Hosp. Rep., 3d ser., vi. 483, where a full account of the subject is given by Dr. Taylor and Dr. Pavy.

the protiodide. A striking case illustrating the poisonous action of the biniodide of mercury has been published by Asst. Surg. M. K. Taylor, U. S. A.[1] A soldier affected with syphilitic ozæna swallowed a solution containing two grains of biniodide of mercury and one drachm of iodide of potassium. Slight nausea was followed by some pain in the stomach, severe pain in the back of the neck, and frothing at the mouth, insensibility, and heavy stertorous breathing. The pulse was 80, the face turgid, the pupils dilated and unaffected by light, the trunk bent rigidly backwards, and the flexor muscles of the legs spasmodically contracted. The muscles of deglutition were paralyzed, and when the patient was removed to his bed, he had "a moderately severe epileptic convulsion." Vomiting was provoked by means of lime-water, bicarbonate of potassa, and ipecacuanha successively administered, after which consciousness was restored. The patient complained of pain and a sense of constriction in the throat, and in about thirty hours moderate ptyalism occurred. There was no diarrhœa. Recovery rapidly followed.

Action of Cyanide of Mercury. *On Animals.*—Ollivier d'Angers gave seven grains of this compound to a bitch. Within five minutes retching occurred, with debility, spasms, insensibility, and slowness of the pulse and respiration. Ten grains occasioned death in seven minutes, with like symptoms. In some experiments, the blood found in the heart was liquid, in others firmly coagulated. No special lesions of the stomach were noted, unless the animal survived the experiment for several days, and then it was evidently inflamed.

On Man.—In a case where about twenty grains of this preparation were taken, vomiting, purging, and excruciating pain in the bowels were experienced. Death did not occur until the tenth day. Meanwhile the patient was prostrated, the action of the heart slow but strong; salivation occurred, with ulceration of the mouth; nausea, vomiting, and bloody stools with tenesmus, were frequent; and the urine was very scanty. Partial erections of the penis and a purplish hue of the scrotum were observed, and death resulted from progressive exhaustion, interrupted occasionally by spasms. On post-mortem inspection no ulcers of the stomach were found, but its lining membrane was swollen, discolored, and softened, and a like change existed in several parts of the intestine.[2] Two grains of cyanide of mercury were taken by a young man, dissolved in the last one of several glasses of beer. Nausea and vomiting soon ensued, and then diarrhœa with severe colic, faintness, headache, and a sense of great coldness. On the next day the face was bluish, the pupils largely dilated, the heart's impulse feeble, the pulse 130 and weak, the senses perfect; the abdomen was indolent, and there was tenesmus and diarrhœa. On the third day deglutition was difficult and the fauces very red; the diarrhœa ceased, and there was suppression of urine which continued for five days longer. On the

[1] Boston Med. and Surg. Journ., June, 1870, p. 499.
[2] ORFILA, Toxicolgie, i. 735.

seventh day some blood was voided *per anum*, and the next day blood was vomited and also discharged from the nostrils; vesicles formed on the tongue and gums which subsequently were converted into ulcers, and a copious salivation took place. The same symptoms occurred frequently, but with diminishing severity, until complete convalescence at the end of the third week.[1] *Sulphocyanide* of mercury, in the form of a toy called "Pharaoh's Serpent," is virulently poisonous. In a case in which a portion of one of these bodies was swallowed, the symptoms were: metallic taste in the mouth, constriction of the throat, heat and pain in the stomach, nausea, vomiting, pallor, extreme debility, and a cool skin.[2]

Action of Yellow Sulphate of Mercury. *On Animals.*—Hillefeld gave forty grains of this substance to a kitten, causing emesis followed by retching, debility, and death.

On Man.—Hoffmann states that it occasions anxiety, colic, violent emesis, diarrhœa, and internal cramps, and a similar account is given by Hellwich. There appear to be but two cases on record in which it produced fatal effects. The patient in one case was a boy sixteen years of age. He took about one drachm, which produced a burning sensation in the mouth and fauces, with vomiting, purging, cramps, and general sinking. The stomach remained very irritable, and great salivation ensued. Death took place in a week. The œsophagus was inflamed, and the stomach ecchymosed.[3] In the second case, a man, æt. 27, took forty grains of this medicine by mistake for æthiops mineral. The primary symptoms were precisely the same as in the case just related. Death occurred at the end of ten days. The inner surface of the mouth, gums, palate, and fauces was covered with black sloughs; the parotid and submaxillary glands were enlarged; the mucous membrane throughout the intestinal canal was softened and easily torn; the glands of the stomach and intestines unnaturally large; the kidneys much enlarged, and the bladder full of urine.[4]

Action of Solution of Nitrate of Mercury.—This preparation, when applied to ulcerated surfaces, has sometimes occasioned symptoms of mercurial poisoning. The same effect has been observed to follow its use as a remedy for the itch. By mistake a strong solution of the salt was applied instead of a liniment to the chest of a delicate woman. A large eschar was formed, and beyond it the skin was severely inflamed. Besides extreme prostration and collapse, there was severe epigastric pain, with almost constant nausea and vomiting of bilious matter streaked with blood. The gums were swollen and bleeding, and ulcerated at their attachment to the teeth. On the ninth day death took place. Mercury was found in the liver.[5] A case of chronic poisoning by this salt, occurring in a man employed to pack skins, is reported by Dr. Taylor.[6]

[1] Moos, Virchow's Archiv, xxxi. 117.
[2] Bull. de Thérap., lxix. 286.
[3] Letheby, Lond. Med. Gaz., xxxix. 474.
[4] Taylor, Guy's Hosp. Rep., 3d ser., x. 180.
[5] Edinb. Med. Journ., x. 167.
[6] Loc. sup. cit.

General weakness was followed by the loss of complete control over the limbs, by a tremulous and subsequently a spasmodic motion of them much resembling chorea, and by constipation; delirium succeeded and then exhaustion, terminating in death. No lesion was detected. Of its internal effects, the following illustration is furnished by Dr. Bigsley.[1] A butcher's boy swallowed about a teaspoonful of the solution which is used for curing the "foot halt" in sheep. He was in great agony with severe burning pain in his mouth, throat, and abdomen, which was tense and sore; he retched violently, had feculent stools, cold extremities, and a small frequent pulse. He died within three hours. On examination, the fauces were vesicated, the pharynx inflamed and discolored by purplish blotches; the stomach presented a similar appearance, and in its greater curvature a space of several inches in extent abounded in brown eschars.

Mode of Operation.—The ingenuity of man has been largely taxed to discover, or to invent, an explanation of the effects of mercury. No other medicine, except cinchona, is so palpably curative of certain diseases, and yet none more perfectly conceals the secret of its operation. Of the hypotheses which have been framed to explain its action, each one, perhaps, contains some portion of the truth, and, taken together, they, no doubt, include all the material elements for the solution of the problem. But as the diseases which mercury cures are various, we may infer that its operation is complex, and in this fact discern the obstacle that hinders a more perfect discovery of its mode of action. The theories which, at different periods, have been proposed in reference to this question, appear to have been formed from too exclusive a consideration of the operation of mercury in syphilis, in inflammations, and in gastro-hepatic affections. It was supposed, by very high authorities, to cure syphilis by means of its weight, divisibility, motility, etc., these properties enabling it to penetrate the finest bloodvessels, to break up the blood-globules, and thus diminish the crasis of the blood. Others imagined that it acted chemically, neutralizing the poison of syphilis; and others still sought refuge in the use of words without knowledge, and maintained it to be now a stimulant, and now a sedative, according to the exigencies of the case. It would be a profitless task to follow the advocates of these and other hypotheses, in their wide circuit of reasoning and illustration, and we shall here endeavor merely to express summarily the conclusions to which it is believed the considerations already set forth conduct.

It is certain that mercury, in all its modes of administration, is absorbed; that, like all other substances foreign to the organism, it acts as an irritant; and that it tends to impair the normal energy of all the nutritive operations, on the one hand by hindering the conversion of the blood into living tissue, and on the other by promoting the dissolution of the latter and its elimination, along with unorganized materials, with all the secretions, and especially with

[1] London Med Gaz., vii. 329.

those of the salivary glands, the pancreas, the liver, and the intestinal follicles. By promoting absorption and secretion, it hastens destruction, as all the phenomena of mercurialism make clearly manifest. It may be questioned whether this deterioration of the solids is the cause or the effect of those changes in the blood which consist in the diminution of its fibrin and the disintegration of its red corpuscles. The latter opinion appears to be the more probable of the two. This solvent influence is most manifestly exerted upon all imperfectly organized structures and particularly upon those which result from inflammation. Hence the aplastic power of mercury has always ranked as its most important quality. While carrying on the destructive process, it, indirectly at least, augments the excitability of the nervous system, and renders the whole organism peculiarly susceptible to external impressions, and therefore, to the influence of the greater number of morbid causes.[1]

Remedial Employment. *Syphilis.*—For two hundred years before the beginning of the present century it was universally believed, not only that mercury is a specific for syphilis, but also that it is essential to the cure of that disease. But during the Peninsular war a number of British army surgeons, among whom were Fergusson, Rose, Hennen, and Guthrie, and in civil practice Drs. John Thomson, Abernethy, and others, proved conclusively that primary syphilis generally tends to a spontaneous cure. Some even took the ground that the remoter (secondary and tertiary) forms of the disease are really produced by mercury, and that "the mercurial disease attacks all those parts which are the seat of syphilis, that it attacks them in nearly the same order, and assumes very nearly the same external appearances."[2] So Bretonneau, by experiments upon animals, discovered that by an excessive use of various mercurials, it is possible to produce in them symptoms having a perfect resemblance to those of constitutional syphilis, such as affections of the bones, and of the periosteum, and ulcers of the mucous membranes.[3] These facts are not, indeed, adverse to the administration of mercury in syphilis, but an argument rather in its favor as a mode of treatment for the secondary and tertiary symptoms. As to primary syphilis, conclusive evidence exists of its curability without mercury. At different times it has been successfully treated with sarsaparilla, opium, ammonia, etc. Sir B. Brodie, in his lectures, relates the success which attended the treatment, by Mr. Rose, of primary syphilis among the British regiments of Guards without mercurial medicines. But he is solicitous that no application should be made of this fact to the management of the disease in private practice; for, as he remarks, "the soldiers were picked men, and perfectly under control in respect to diet, exercise, etc., and he adds that to treat syphilitic patients in

[1] The mode of action of mercury has been examined by HEADLAND, Lancet, March, 1858, p. 309; and BARENSPRUNG, Annalen des Charité-Krankenhaus, Berlin, 1856; Journ. f. Pharmacodynamik, i. 418.

[2] MATTHIAS, Lond. Month. Rev., Feb. 1811.

[3] Annuaire de Thérap., 1848, p. 263.

civil hospitals or in private practice without mercury would be altogether a failure."[1] So Hocken[2] remarks: "Because syphilis can be cured without mercury it does not follow that such a plan of treatment is the best, or that we should proscribe so useful a remedy." And Wallace, of Dublin,[3] expresses the same idea, when he says: "Not that mercury is indispensable for procuring cicatrization of the primary ulcer, but because it hastens the process of healing, and diminishes the chance of secondary symptoms." To quote the results of experience as they are recorded by Desruelles, Fricke, Syme, Drysdale, Bennett, Boekh, Cooke, Wells, Diday, and many others, some of whom had opportunities of studying venereal diseases upon the largest scale, would only be to accumulate proofs of what cannot be controverted. The result is that the doctrine which Hunter taught imperfectly is now a demonstrated truth, viz., that the true lesion of primary syphilis is an indurated chancre, and that this alone is liable to be followed by constitutional disease. All others may be classed under the general term *chancroid*, which was first applied to them by Diday, and has been adopted by our countryman Dr. Bumstead.[4] In regard to these, or soft chancres, it is a well-settled rule of practice that they should not be treated with mercury.

Ricord (and in this he followed the principles of Hunter) refrained as much as possible from giving mercury during the primary affection, upon the ground that it does not prevent the occurrence, although it may postpone the development of the constitutional disease, and thus prolong the patient's anxiety in regard to its appearance.[5] In this judgment the greater number of writers on syphilis concur. When secondary symptoms arise, it is generally within six months after an indurated chancre. Now it is certain that mercurials during the primary symptoms are generally unnecessary for their cure, and may postpone, but will not prevent, the occurrence of constitutional infection. Although induration of the chancre is the first step towards infection of the system, of which inguinal glandular enlargements, and characteristic cutaneous eruptions are further and more complete evidences, its removal will not prevent these ulterior effects; and although simple treatment will usually heal the sore, yet its cicatrization may sometimes be hastened by mercury when the circumstances of the patient do not permit him to await a tardier cure.

There are certain *contraindications* to the use of mercury which ought never to be lost sight of. It should not be prescribed when the skin around the sore is very red, swollen, tense, and painful, or shows a tendency to gangrene; nor if the digestive organs are deranged, nor if any febrile or other marked constitutional disturb-

[1] Clinical Lectures on Surgery (Am. ed.), p. 225.

[2] De la valeur comparative des préparations de mercure et d'iode dans le traitement de la syphilis. Annales des Mal. de la Peau, i. 341.

[3] A treatise on Venereal Diseases, p. 100.

[4] The Pathology, etc., of Venereal Diseases, 2d ed., 1864.

[5] Annuaire de Thérap., 1848, p. 267.

ance exists. Such conditions should first be rectified, whether in the primary or in the consecutive forms of the disease. When, too, either form of syphilis occurs in a person affected with anæmia, scrofula, tuberculosis, or scurvy, or in one suffering from the consequences of intemperance in alcoholic drinks, the use of mercurials demands the utmost circumspection, and is indeed generally contraindicated until a better state of health is obtained by the use of other remedies. If the dyscrasia arise from syphilis itself, this condition is not a contraindication for the use of mercury. In regard to its employment during pregnancy, and especially during the latter months of this state, opinions are not uniform. Some allege that it may cause the death of the fœtus and abortion. But, on the other hand, it is maintained, and with more probability, that a moderate mercurial course, without salivation, tends to prevent abortion, and to prevent or to cure the infection of the fœtus. In such cases it is said that inunction is preferable to the other modes of exhibiting mercury.

The method of mercurial treatment which prevailed until comparatively recent times may be judged of from the following aphorisms of Boerhaave.[1]

"When pustules spread all over the body, when pains seize the joints, when there are nocturnal pains, large buboes, racking pains of the bones, repeated gonorrhœa, it is then certain that the patient is poxed, and that a salivation is required.

"To raise a salivation with greater success, let the patient for some days be filled with ptisan.

"Then, every two hours, administer a suitable dose of mercurius dulcis.

"As soon as the breath begins to be offensive, the gums to be painful, the teeth to loosen, then ought the physician to consider whether salivation should go on, remain in its present state, or be lowered.

"If three or four pounds of saliva are spit every twenty-four hours, it is sufficient.

"If the patient spits less, the salivation is to be increased, by giving a dose or two of the same medicine.

"If the salivation should be greater than the strength of the patient can bear, it is to be checked by mild clysters, purges, or sudorifics.

"If the mercury runs off by stool, an opiate and a diaphoretic will be necessary.

"When the mouth, gums, and fauces swell too much, or grow very painful, a soft, lenient gargle or lotion is to be used, etc.

"The salivation is to be continued until all the symptoms of the disease vanish, which generally takes up about thirty-six days.

"Then a small dose of mercury must be now and then taken for thirty-six days more, to keep up a very gentle salivation."

Although the celebrated commentator, Van Swieten, has graphi-

[1] VAN SWIETEN'S Commentaries, xvii. 230.

cally described what he very aptly calls "the tortures of salivation," still he echoes the direction of Boerhaave, and of Astruc who preceded him, that, "if the patients spit three or four pints of saliva every twenty-four hours, it is thought sufficient." Nor is this prescription so antiquated as to find no acceptance at the present day, for, in the opinion of Trousseau and Pidoux, physicians, in spite of themselves, relax the severity of a treatment which they believe to be the best, and by this unfortunate leniency certainly become chargeable with occasioning the present deplorable frequency and gravity of constitutional syphilis.[1] Ricord, on the other hand, says, emphatically, "It is very certain that syphilis is never cured by the exaggeration of any of the effects of mercury, as fever, increase of the urinary secretion, alvine evacuations, cutaneous irritation, or salivation."[2] Canstatt, comparing the harsher and the milder methods, says: "To the latter I give my unqualified adhesion;"[3] and Sigmund, in charge of the great venereal wards of the Vienna Hospital, reports as follows: "Of 8983 syphilitic patients treated with mercury, 8463 exhibited no salivation, and yet were just as permanently cured as those in which this occurrence took place."[4] This gentler plan of treating syphilis is not, however, novel and modern. Its superiority was asserted even during the supremacy of the humoralistic doctrines, which have to answer for the incalculable evils resulting from the abuse of mercury. In 1516, Almenar, a Spaniard, recommended mercury in syphilis, "but not to promote a salivation."[5] In a treatise published in 1718, Chycoineau, the king's physician in the University of Montpellier, advocated the method *per extinctionem*, in which all possible care was taken to prevent a salivation.[6] So Plenck (1766) maintained that salivation, far from being attended with any advantage, constantly retards a cure, and subjects the patient to many inconveniences. "It is," he continues, "very inconvenient and dangerous and does not give a certain cure, is not critical, nor can it be excited in every subject, *nor is it necessary in any*."[7] The observation of physicians of the nineteenth century has led to no more definite conclusion than this.

It may be inferred from the preceding statements that the rules for the administration of mercury in constitutional syphilis should all be subordinated to the fact that salivation is a morbid process, and is, therefore, to be avoided. The doses of the medicine which are required to duly affect the system will depend upon the preparation used, and upon the age, constitution, and individual peculiarities of the patient. They should at the beginning of the treatment, however, always be very small. They may afterwards be gradually and cautiously increased, to be again diminished or suspended if

[1] Traité de Thérapeutique, 5ème éd., i. 215.
[2] HUNTER and RICORD on Syphilis, by BUMSTEAD, p. 466.
[3] Med. Klinik, ii. 858.
[4] Brit. and For. Med.-Chir. Rev., July, 1858, p. 266.
[5] ALSTON, Mat. Med., i. 82. [6] VAN SWIETEN, op. cit., xvii. 263.
[7] PLENCK, on Mercury.

they produce morbid effects. The progressive increase of the dose ought generally to be interrupted whenever the symptoms begin to decline, to be again resumed, however, if the disease tends to revive. An important practical question here presents itself, and one most difficult of solution, viz., for how long a time the mercurial treatment must be continued? To this question no positive answer can be given, for it must be confessed that no term of mercurialization, however long, can infallibly secure the patient against ulterior outbreaks of syphilis. All that can be said is, that the most competent authorities agree to recommend a period of about six months, during which the system should be kept under the influence of the medicine.

Forms of Mercurial Treatment used in Syphilis. Inunction.—This, the oldest of the methods employed, is not without its partisans at the present day, although it is very generally abandoned. Sir B. Brodie remarks: "It is dirty, laborious, and troublesome, and makes the case public to the family in which the patient lives, but it is much less liable to gripe and purge than mercury taken by the mouth; it cures the disease a great deal better, and does not damage the constitution half so much." But it must be properly applied, and continued until the hardness of the primary sore disappears, and for some time afterwards, or until the mouth becomes slightly affected. In secondary syphilis, it should not be desisted from until after the disappearance of all the symptoms. Before commencing the treatment the patient should live for some days upon simple food, take a laxative medicine, and cleanse the skin thoroughly by warm bathing. The frictions with mercurial ointment should generally be made in the evening and near the fire. If possible, they should be performed by the patient himself, or, if by an attendant, he should have his hand protected by a caoutchouc glove, or by a pig's bladder previously softened with warm water. The places selected for friction should be used alternately or in succession, as for instance the thighs, the armpits, the legs, the arms, etc., and if the part is hairy, it should be shaven, and the frictions made in the direction of the hairs. The stronger ointment of mercury is to be preferred, and of this one or two drachms may be rubbed in daily. The patient should be clothed in flannel, and every two or three days renew the cleansing of the skin by means of a warm bath. If salivation ensues, the treatment must be temporarily suspended.

In cases of infantile syphilis, Sir B. Brodie recommended the application of a flannel roller smeared with mercurial ointment, around the child's body, as preferable to "the cruel practice" of giving the medicine to the nurse, or to running the risk of deranging the digestive organs of the child by its internal administration. The two methods were used conjointly by Mr. Wormald, of St. Bartholomew's Hospital.[1] In 1735, Columbier, of Paris, described the mercurial treatment of syphilitic infants by means of the inunction of

[1] Times and Gaz., Nov. 1853, p. 502.

their nurses. He alludes to its tendency to derange the bowels of the infants if not used in great moderation.[1]

Murcurial Fumigation.—This mode of applying mercury to the cure of syphilis was almost contemporaneous with the first advent of the disease, but it was probably long before employed in China and other oriental countries. It has the great advantage of cleanliness over the method by inunction, and spares the digestive organs the derangement which the internal use of mercurial medicines is sure to occasion. Although so early resorted to, it fell into disuse in consequence of the annoyance experienced by the patients inclosed in boxes or chambers where they were compelled to breathe an atmosphere loaded not only with mercurial vapors, but with those of charcoal as well. No objection to the method can now be made upon any substantial ground, particularly when the nature of the disease for which it is employed need not be kept secret. For its application an ordinary spirit lamp, such as is used for warming infants' food, is sufficient. In this the mercurial preparation may receive the heat directly through the metallic vessel, or by the intervention of one containing water. In the absence of such an apparatus a hot brick or stone will answer the purpose very well. Either may be placed under a chair on which the patient sits, enveloped to the neck in a blanket which also includes the chair, so that his whole body is exposed to the mercurial vapor. The temperature of the air speedily induces copious sweating, which should be maintained for fifteen or twenty minutes, after which the lamp may be extinguished and the patient allowed to cool gradually, and then may be put to bed wrapped in a flannel garment or in a blanket, and with the mercurial deposit adhering to the skin. This treatment should generally be resorted to every other night, at first, but afterwards, as the cure advances, at longer intervals. Various forms of mercury may be used for fumigation, but calomel and the black oxide are quite equal to any others for all purposes, and are superior, especially to the compounds with sulphur, when syphilitic disease of the fauces, nares, larynx, etc., renders it desirable to apply the fumes directly to these parts.

Calomel and *Blue Pill* are the two forms of mercury most frequently employed in Great Britain and the United States, for internal administration. They both salivate with facility, but in this respect calomel is most objectionable, at least in doses of half a grain or a grain three times a day, united with opium to prevent its acting upon the bowels. Dany[2] prescribed one grain of calomel with fifteen grains of sugar, divided into six parts, of which one was given every two hours. The cases treated by him were seventy-two soldiers, of whom twenty-eight had primitive chancres, ten secondary syphilis, and thirty-four gonorrhœa. On the last the treatment had no effect, but it cured the others. Simple chancres healed in from twenty-five to thirty-five days, and the indurated and inflamed, in from forty-five to sixty days. The secondary

[1] DUNCAN's Commentaries, xi. 280.

[2] Journ. de Méd. (1846), iv. 203.

forms of the disease for the most part disappeared in from twenty-five to thirty-five days. In these experiments of M. Dany, which were not exactly according to Law's plan, salivation sometimes occurred. On the whole, the duration of the chancres appears to have equalled that observed in the use of a purely local treatment.

The remoter forms of syphilitic infection are sometimes, but not generally, treated by calomel. Thus Graves,[1] in syphilitic periostitis of the cranium, recommended this preparation to be given in doses of a scruple to a drachm in the course of the day, and to be persisted in, in spite of salivation, and the dose even to be increased, until the pains disappeared. It must be confessed that this plan does not commend itself by its safety.

Iodides of Mercury.—The combination of iodine with mercury was first proposed and executed by Odier, of Geneva, in 1814, but was first employed by Biett as an external remedy for syphilis in 1821, and internally in 1826.[2] He thought it was recommended by its comparatively slight action upon the bowels. It has since that time continued to be the favorite antisyphilitic mercurial employed by Cullerier, Ricord, and others, especially in secondary ulcerations of the mucous membrane, cutaneous tubercles, exostoses, and chronic affections of the joints. The following is the mode of administration employed by Ricord. The protiodide (green iodide) is made into pills of one grain each, and one of these is given daily during the first two or three days of the treatment, and then the dose is gradually increased until it reaches three, four, five, or more pills a day, or until some effect upon the symptoms is discovered. If the medicine does not derange the digestive organs or induce soreness of the mouth, it is continued at the same dose; or if such effects occur, its quantity is diminished. Ricord maintains that the efficacy of the medicine is impaired in exact proportion to the derangement of system which it causes. The appropriate dose in each case must be determined by its peculiarities. According to Ricord, the requisite duration of the treatment varies between three and six months. In persons of good constitution the former period may suffice, but under opposite circumstances the longer time is required. When the constitution is impaired, however, the action of this and of all mercurial preparations is often pernicious if unmodified by other remedies, such as iron and vegetable tonics, with nutritious food and favorable hygienic influences.

In 1826 Biett extolled the use of the *biniodide* (red iodide) of mercury as an external application. It had still earlier (1822) been employed by Brera of Padua, as an internal remedy, in doses of one-sixteenth of a grain. In 1836 Gibert claimed for it superior advantages, which, however, he does not appear to have realized.

Corrosive Sublimate.—This preparation was first used in syphilis by Matthiolus, and afterwards by the celebrated Sanchez, from whom the mode of administering it was borrowed by Van Swieten. The account given by the latter of the certainty and ease with which

[1] Clinical Med., p. 628.

[2] Bull. de Thérap., i. 369.

it cured, when compared with the revolting and mischievous operation of metallic mercury, mercurial ointment, and other salivant preparations, is highly interesting.[1] In general, it is found to salivate unless given in doses of at least half a grain twice a day, a fact which, we think, refutes the ingenious chemical hypothesis that has been framed to account for this effect of mercury, and which has been explained in another part of the present article. Van Swieten generally gave a quarter of a grain in spirituous solution twice a day, and found that if twice this dose was exceeded, it was apt to salivate or to excite pain and purging. In England the most favorable accounts of its operation were published by Gordon,[2] Pringle, and Whytt,[3] and more recently it became the favorite remedy of Lagneau and Dupuytren. Gilbert, among late writers, gives it the preference over other mercurial preparations,[4] but he regards it as important that it shall be so administered as to moderate its local action upon the stomach, and for this purpose he employs it dissolved in syrup, or, preferably, prescribes it in pilular form with some bitter extract, and always with opium. In London we are told that the daily experience of the Hospital for Diseases of the Skin proves that small doses of the bichloride may be given, without risk of any evil consequences even at the most tender age. The dose habitually prescribed for an infant of from one to two months is about one-ninetieth of a grain, in solution three times daily, and it is usually combined with as much laudanum as may be necessary to relieve the extreme restlessness which often attends the disease.[5] To prevent decomposition of the salt it may be associated with muriate of ammonia. *Baths* of the bichloride have been employed successfully and highly recommended by Wedekind. He used from a drachm to an ounce of the salt in a bath at from 82° to 96° F., for half an hour, and from that to an hour. Meanwhile the affected parts were diligently rubbed with the hand. After the bath the patient was kept warm in bed for an hour, and his sweating encouraged. The effect upon the skin was to produce a general prickling, with redness, and when the baths had been used for some time it grew harsh, the cuticle exfoliated, and the nails assumed a grayish color. In no instance was salivation excited.[6]

Hypodermic Use of Mercury in Syphilis.—The prevalent use of hypodermic injections of narcotic and some other medicines naturally suggested the possibility of introducing mercurial salts into the economy by the same method. Indeed, the original proposer of the method, Dr. Hunter, injected twenty-five grains of corrosive sublimate in the course of as many weeks, for the cure of syphilis. In 1864, Scarenzio employed calomel after this manner, and in 1866 corrosive sublimate was used by Berkley Hill. About the same time Lewin, of Berlin, employed the bichloride on a large scale,

[1] Commentaries, xvii. 292.
[2] Med. Obs. and Inq., i. 365.
[3] Ibid., ii. 213.
[4] Maladies de la Peau, p. 695.
[5] Times and Gazette, Nov. 1853, p. 502.
[6] Beiträge zur Erforschung, etc., p. 103.

and published afterwards an extended report of the results of his experience. In 1868 Martin proposed to inject the double iodide of mercury and potassium, and in the following year Bricheteau directed attention to the iodide of mercury and sodium. Liégeois proposed to add muriate of morphia to a solution of corrosive sublimate. According to the last-named authority, the advantages of the hypodermic method of treating syphilis are the following: 1. It can be readily applied. 2. It guards against local affections. 3. It diminishes the chances of salivation. 4. Its efficacy against secondary affections is very great. 5. It does not disturb the important functions of the economy. 6. It seems to expose the patients less to relapses than other methods of treatment. 7. The relapses are generally very mild.[1] On the other hand, Grünfield found it neither more rapid nor more certain than the usual modes of administering mercury, nor more efficient in preventing relapse; he describes the local irritation it produces as "violent," and holds that the pain it causes and the possible ulceration should be weighed against its alleged advantages. Stöhr makes similar objections to the method, adding that it excites salivation more frequently and earlier than other methods.[2] A judgment less favorable than the former and less condemnatory than the latter of these, may be expressed in the words of Appert: "It is evident that the treatment by injections cannot become general on account of its drawbacks, but that is a great advantage to have it introduced into practice. It fills up a gap in the chain of therapeutical agents against syphilis. Cases which have resisted other remedies may be benefited by it; cases where the skin is so covered with eruptions that inunction cannot be applied may be cured by injections, also where the digestive organs forbid the continued use of internal remedies. Patients who are pressed for time may resort to it; and some forms of infantile disease (where we wish to arrest its progress quickly) and of cachexy, may possibly require it."[3] It is certain that although several years have elapsed since these opinions were expressed, the hypodermic method of treating syphilis has not become general. It is recommended to make two injections daily, of from $\frac{1}{12}$ to $\frac{1}{8}$ gr., under the skin of the back, and to suspend them if salivation occurs. From fifteen to thirty such injections are said to be necessary to effect even an apparent cure.

Fevers. Typhoid Fever.—The advantages of a purgative treatment in this disease appear now to be well established by the concurrent testimony of physicians in various countries. It reduces the abdominal distension, calms the delirium, and allays the fever; the tongue under its influence grows soft and moist, and very probably it tends to eliminate by the bowels the poisonous cause of the symptoms. Among those who have sought to produce these effects by calomel since the diagnosis of typhoid fever has been sufficiently understood may be mentioned Ross, Sicherer, Taufflieb, Schoenlein,

[1] BRAITHWAITE's Retros. (Am. ed.), l. 144.
[2] Practitioner, iii. 130.
[3] Trans. Clinical Soc., iii. 42.

Fauconnet, Lombard, Serres, Becquerel, and Canstatt. Mr. Ross, indeed, somewhat anticipated the knowledge of this diagnosis in Great Britain. In an article treating of the disease under the name of *typhus hecticus*,[1] he strongly recommends calomel, not as an alterative, which he considered dangerous, nor yet as a purgative, but solely "as a sedative," *i. e.*, in doses of one to two scruples, repeated three times during the first three or four days of the attack. Administered in this way, it neither salivates, nor purges beyond procuring two or three stools. It is advised, however, that if it do not purge, as it sometimes does not, an aperient should be given, as, for instance, twenty-five grains of jalap with a like quantity of calomel. Mr. R. states his belief that this remedy promotes the healing of the intestinal ulcers, and he states that he employed it nearly one hundred times, and always with perfect safety to the patient. Sicherer, of Heilbronn, treated 640 cases of the disease by full doses of calomel, and lost but 19 of the number. He gave an emetic the first day; and on the second fifteen grains of calomel, producing from seven to twelve stools; and on the third day, the same dose, which occasioned four or five stools only. On the fourth day no medicine was administered, but on the fifth day a dose like the former produced from one to three stools. In this way the typhoid or nervous stage of the disease is said to have been prevented.[2] Taufflieb has examined this mode of treatment very thoroughly, and arrived at important conclusions. These were drawn from a comparative study of 518 cases of typhoid fever occurring during a period of fifteen years. He inferred from his observations that mercurial purges have a peculiar and, as it were, specific power of arresting the progress of the disease. The mercurial action may be primitive or secondary, purgative or sialagogue, but either is curative when established near the commencement of the attack. Out of the 518 cases, 305 were subjected to the calomel treatment before the tenth day of the disease, which was then arrested within two or three days after the administration of the medicine. Its first effect was generally to produce several brown or green, slimy stools followed by a decided sense of relief. In 230 of the 305 cases, convalescence immediately followed the purgative operation, and in only 12 of them did salivation occur. In 75 other cases, the purging produced no permanent benefit, but salivation took place, and subsequently convalescence set in. Large were more successful than small doses. In 331 cases the average amount of calomel taken by each patient did not exceed fifteen grains, and in this group the mortality was one in six, while in 187 other cases, where the average doses were five or six grains three times a day, so that each patient took in all from fifty to sixty grains, the mortality was only one in fifteen. Of the 213 cases which ran their course without either purging or salivation, 165 were for the most part mild. In 22, characterized by nervous derangement, and in 26 of an adynamic type, the symptoms were aggravated by the medicine.

[1] Lancet, 1842–3, i. 888, 891. [2] Bull. de Thérap., xl. 119.

A portion of the cases used mercury only by inunction, and the salivant action in these, as the purgative action in the others, seemed immediately to precede an improvement in the symptoms. When neither effect was produced the medicine appeared to be injurious.[1] It is impossible, on weighing these results, not to doubt the correctness of the diagnosis in many of the cases, and especially in all of those which are said to have been cut short by the treatment. Typhoid fever cannot be arrested in its course by any medicine or mode of treatment. In all probability, the cases reported to have thus terminated were examples of simple continued fever without intestinal lesion.

Constatt gives a favorable opinion of calomel in this disease; at least, it procured for him more satisfactory results than other remedies during the epidemics in which he employed it. He says, and here he agrees with Mr. Ross, cited above, and all others who have treated of purgatives in typhoid fever, that calomel is only useful when given during the first days of the attack; in the nervous or ataxic stage it is clearly mischievous. He directed from ten to twenty grains for adults and five grains for children and nervous girls, to be repeated twice, thrice, or four times, according to circumstances, and so as to produce two or three stools daily. By the third or fourth day, the stools become browner and more feculent, and then the calomel should be discontinued.[2]

Clarus gives the following conclusions from clinical observations of the treatment by calomel in purgative doses. It is useful in the first stage of typhoid fever before the spleen is enlarged, or the intestinal ulcers are formed, and in patients of good constitution with evidences of plethora. It allays the cerebral symptoms, the fever, and the heat of the skin, and rather diminishes than augments intestinal irritation.[3] M. Serres combined the use of mercurial friction with the internal administration every second day, or three or four pills each containing four grains of black sulphuret of mercury. Six or seven days usually elapsed before any signs of salivation appeared, upon which the frictions were suspended, and the internal doses diminished one-half. The effect of this treatment is said to have been apparent within three or four days, in the subsidence of the fever, and convalescence was decidedly entered upon between the eighth and the fourteenth days. The patients remained in the hospital from thirty-five to fifty days.[4] The general results here given have been confirmed by Becquerel, who employed the same preparation of mercury;[5] but they do not appear to be as favorable as those obtained by an expectant treatment alone. It cannot be too often repeated, that typhoid fever is a disease remarkably liable to variation of type, so that the treatment which succeeds best in one year is not always the most successful in the following year. Whether there is any type of the disease, or any

[1] Bull. de Thérap., xl. 117, 149, 250.
[2] Handbuch der Med. Klin., ii. 577.
[3] Handbuch der Arzneim., p. 818.
[4] Annuaire de Thérap., 1848, p. 172.
[5] Ibid., 1851, p. 187.

medical constitution, which renders mercury an eligible medicine in typhoid fever, we very much doubt in spite of the favorable statements which we have recorded. Theory and experience combine to condemn it. If the results of its use have appeared to be more favorable than those of still more perturbative methods, they are indubitably inferior to those of a prudent medical expectation, and a moderate and cautious use of food and stimuli.

In reference to the specific action of mercury, Dr. Nathan Smith informs us that in many instances he saw very serious evils arise from it, and he recommends the medicine to be only occasionally used, and with opium, for the purpose of checking a colliquative diarrhœa.[1] Dr. James Jackson concluded that mercurials have probably no great influence on the results of typhoid fever.[2] Dr. G. B. Wood, on the other hand, entertains an opinion that mercury given so as slightly to affect the gums, is a very effectual remedy for the dryness of the skin and tongue, with scantiness of the urine, tympanites, and stupor, which are apt to occur about the ninth day, *i. e.*, at the height of the disease.[3] The natural tendency to cure, of many cases of typhoid fever at this stage, is not to be lost sight of. It is the period, we are disposed to think, at which gentle diffusible stimulants and nutriment are best adapted to remove the condition referred to; the period at which that condition is beginning to be established, when the oil of turpentine, proposed by Dr. Wood, finds its earliest, though still a very slight indication.

Yellow Fever.—Mercury has been exhibited in this disease in two modes, as a cathartic and as a sialagogue. For its former operation, after having been used by Chisholm and other physicians in the West Indies, calomel was adopted by Dr. Rush, of Philadelphia, who employed it more or less during the successive epidemics of yellow fever that he witnessed. During that of 1793, he prescribed it in doses of ten grains with fifteen grains of jalap, to be repeated every six hours until the medicine procured from four to six large evacuations. The effects of this combination, he remarks, "not only answered, but far exceeded my expectations." During the epidemic of 1794, he increased the dose, so that we read of one patient taking one hundred and fifty grains of calomel in six days. In the subsequent epidemics of 1797, '98, and '99, he appears to have confined the administration of calomel to the beginning of the attack, substituting milder purgatives for it afterwards. The modification which Dr. Rush made in his own practice appears to have been gradually adopted by his imitators, and, at the present day, few can be found to uphold a method which had nothing to recommend it but the authority of a name.

The use of mercurials for their constitutional operation in yellow fever first prevailed in the West Indies, as appears by a reference

[1] A Practical Essay on Typhus Fever, p. 68.
[2] Report on Typhoid Fever, 1838, p. 87.
[3] Practice of Medicine, 4th ed., i. 345.

to the works of Warren, Lind, Maclean, and Chisholm;[1] but it was mainly commended to professional notice by the example and the writings of Dr. Rush. This writer, setting out from a false analogy between yellow fever and bilious remittent fever, concluded that as the method by mercury was—in his opinion—useful in the latter disease, it must necessarily be so in the former. If mercury, as a salivant, were really curative, or generally advantageous, in yellow fever, as it exists at present, the fact would form an exception to all those upon which the best considered views of the operation of mercury are taken. The disease is one which, like typhus, tends to produce a dissolution of the blood, whence proceed the gastric and other hemorrhages which mark the grave and fatal cases of the affection. Such a state must, of necessity, be aggravated by mercurials absorbed into the system, and therefore, before adopting them in its treatment, we ought to possess the most direct and positive demonstration of their utility. But no such evidence exists. In cities where the disease frequently occurs, practitioners have long ago, with few exceptions, abandoned the method as worse than useless, and there is now a general tendency manifested to acquiesce in the opinion formerly expressed by Dr. Robert Jackson. He arrived at "the conclusion that mercurial action manifested by an increased discharge of saliva, instead of being a cause which arrests or suspends the disease by its own proper power, is no more than an indication that such suspension has taken place, either by a process inherent in the constitution, or by forcible means of art. Mercury does not act while the disease exists in force, that is, it does not counteract the progress of the morbid cause while action produced by that cause is in progressive activity."[2] This author also denies the assertion made by the advocates of the mercurial plan of treatment, that no one dies from fever after salivation is fully established, and subsequent writers have confirmed his observation. Yet it must be admitted that, in the great majority of cases treated by mercury, recovery and the occurrence of salivation have coincided; and, could we be sure, on the one hand, that these cases did not recover, in spite of salivation, and, on the other, that some patients did not succumb in consequence of the mercurial operation on the blood, we might be encouraged to employ the medicine. In the midst of doubts suggested by considerations like these, the part of prudence is probably to abstain from mercurialization in yellow fever, as a general rule. At the same time, this disease is singularly prone to assume a variety of types in different localities and seasons, and it is certainly possible, that among these types, a marked inflammatory one may sometimes occur. Such must certainly have been the cases which endured, and apparently were cured by, the profuse depletions of Rush, Moseley, Jackson, etc. In other epidemics, and especially of late years, depletion has not been tolerated, and the symptoms of the disease have justified one of the

[1] La Roche, Yellow Fever, ii. 660.
[2] A Sketch of the History and Cure of Febrile Diseases, etc., 2d ed., 1820, ii. 288.

names imposed upon it—*typhus icterodes*. In so far as the elements of a typhoid condition are predominant, the utility of mercurials may be, with confidence, denied; but if a sthenic inflammatory state prevail, they will undoubtedly be tolerated, and may, perhaps, be useful.

Bilious Remittent Fever.—The cholagogue action of mercury is invoked in this affection to relieve the overloaded liver, as it is in yellow fever to stimulate the non-secreting liver. Leaving unattempted here the task of reconciling these apparent contradictions, let us endeavor to learn whether or not experience has proved mercurials to be useful in bilious remittent fever. In reference to their *purgative* action, it may be remarked that this is generally sought for at the beginning of an attack, by the administration of ten grains of calomel at bedtime, and some saline laxative, or else jalap, on the following morning. But even at this stage such treatment is unnecessary, unless the abdomen is full and hard, the tongue much coated, and the alvine evacuations sensibly disordered. In this disease the real remedy is quinia, and it is much better to obtain its specific operation as soon as possible, feeling assured that then the associated local derangements will be all the more readily removed.

It may be presumed that the employment of calomel as a constitutional remedy in this disease, whether by the daily repetition of slightly laxative doses, or the more frequent administration of still smaller quantities, is still the general practice in some portions of the United States.[1] So far as those forms of the disease are concerned which originate in the Middle States of the Union, we have never found it necessary to prescribe mercurials except as purgatives, relying, for the cure of the disease, upon quinia alone. It is possible that the more inflammatory form of remittent fever met with in southern latitudes may call for a different management. But the excellent reports of Dr. Boling, and several other southern physicians, render this supposition improbable. Moreover, if we turn to the East Indies, whence the calomel treatment first emanated, we shall find that it no longer holds its original place in the medical creed of that country. One of the most eminent of the East Indian practitioners, Dr. Charles Morehead, says:[2] "The practice, at one time too common, of exhibiting calomel in doses of four or five grains three or four times in the course of the day, without any very definite object in view, and continuing it for a succession of days, cannot be too strongly discouraged. Not only is it unnecessary, but, for the following reasons, often positively injurious. In watching the progress of cases thus treated, it is not difficult to detect a train of symptoms much more fairly attributable to the treatment than to the disease, because it is in cases thus treated that this has been chiefly observed. The symptoms to which

[1] Compare BOLING, On Remittent Fever, Am. Journ. of Med. Sci., July, 1846, p. 29; and DICKSON, Elements of Medicine, p. 243.
[2] Clinical Researches on Disease in India, i. 202, 206.

I allude are uneasy feeling, sometimes amounting to pain, with a sense of oppression or sinking at the epigastrium, and occasionally griping of the abdomen, for which leeches are not unfrequently applied, and purgatives unnecessarily given. The frequent repetition of the calomel keeps up also a foul state of the tongue, nausea and irritability of stomach, aggravates the febrile excitement, and produces an irritable state of the bowels, marked by frequent watery discharges. The convalescence of cases thus treated is always tedious, and frequently complicated with diarrhœa and clay-colored dejections." . . . . . "I am of opinion that an endeavor to induce mercurial influence in remittent fever is erroneous in theory and of no value in practice;" not only so, but "it is opposed to all rational theory, and very injurious in practice. If it be true that prostration of vital actions and a deteriorated condition of the blood are pathological states to be much dreaded in remittent fever, and if mercury deteriorates the blood and favors prostration, on what principle of reasoning can it be supposed that induced mercurial influence can have any other than an injurious effect on remittent fever?" The author further attributes to the mercurial treatment so long prevalent in that country, the frequent occurrence of a cachexia marked by asthenia, dyspepsia, injured teeth, pains in the sides and loins, foul tongue, constipation, pale fæces, and depressed spirits.

In Inflammations.—For the introduction of mercury into the treatment of inflammations we are indebted chiefly to Dr. Robert Hamilton, of Lynn Regis,[1] who, however, derived it from the East Indian practice of treating acute hepatitis. From observing its effects in that disease, in ophthalmia, and in syphilis, he inferred that it would also be efficacious in the cure of all inflammatory affections. He accordingly employed calomel and opium in the treatment of pneumonia, pleurisy, inflammation of the brain and of the abdominal viscera, and also in puerperal fever and rheumatism. He used depletion at the commencement of the attack, followed by a purgative, and then prescribed from one to five grains of calomel, with from one-quarter of a grain to one grain of opium, every six, eight, or twelve hours, according to the degree of inflammation. At the same time the patient was to take copious draughts of barley-water. It was not until after eighteen years' experience with the remedy that Hamilton published his convictions of its utility, and established a practice which almost to the present day scarcely lost ground in the esteem of British and American physicians, although it was much less generally adopted on the continent of Europe. Trousseau, after citing illustrations of the antiphlogistic virtues of mercury, remarks: "We have but little reason for surprise at the faith which our insular neighbors have in the treatment of inflammation by calomel. There must certainly be some good ground for the confidence with which so large a number of physicians—English, East Indian, and American—agree

[1] DUNCAN's Commentaries, ix. 191, 1764.

in according antiphlogistic powers to mercury, and it is really lamentable that in France so many prejudices should be aroused against this heroic remedy."[1] In Germany, likewise, although of more common use than in France, mercury is still employed with comparatively less frequency than in England and the United States; and, indeed, an occasional disposition is shown to banter British and American physicians for their mercurial fetichism.[2]

It is not very easy to furnish demonstrative evidence of its antiphlogistic virtues; but in therapeutical questions the convictions of competent judges must be allowed, to some extent at least, to acquire the authority which belongs to demonstration in the exact sciences. The convictions entertained of the efficacy of mercury as a remedy for inflammation are very decided and deeply rooted. Dr. Latham thus expresses his own opinion, which may be taken as representing the general sentiment of the profession on this subject at the time when it was written. Referring more particularly to phrenitis, peritonitis, pneumonia, and pleurisy, he concludes with these remarks: "The sum of my experience is this, that the acutest forms of these inflammations are arrested more surely and more speedily by bleeding and mercury conjointly than by bleeding alone; and not only more surely and speedily, but by a less loss of blood; in short, that mercury does not supersede bloodletting, but that it aids its antiphlogistic power, and yet spares its amount." It is, then, as an aid to the lancet when bloodletting is called for, and as a substitute for depletion when this cannot be borne, or when the proper stage for its employment has passed away, that mercury has been regarded as useful in the treatment of sthenic inflammation.

It is very difficult to determine how far the exclusion of mercury from the treatment of inflammatory disease, which now is almost universal among enlightened medical practitioners, is the result of a rational conviction, and how far it is a fashion, like numberless others which have originated in a plausible general doctrine or under the authority of an eminent name. The statement of Mr. Holmes,[3] "for myself I may confess that for many past years, in my treatment of inflammation (excepting, of course, certain syphilitic inflammations), I have never had recourse to mercurialism," is an expression of the judgment of surgeons of a corresponding class. Looking at the whole subject, one conclusion appears to be not only warranted but required, viz., that inflammatory affections have been cured quite as rapidly, and much more safely and agreeably, since the fashion of mercurialization passed away, than they ever were during its domination. So far as the experience of a single physician may have any value, we desire emphatically to declare that after nearly forty year's experience in hospitals and in private practice, we have not met with a single case of simple inflammation, acute or chronic, in which the superiority of mercury

[1] Thérapeutique, 5ème éd., i. 223.
[2] NEUMANN, Heilmittelehre, p. 285.
[3] A System of Surgery, 1869, i. 103.

over less dangerous medicines was unequivocally demonstrated. During the same period numberless examples have fallen in our way of the serious evils of mercurialization in such affections, and not a few which suggest the thought that it would be far better the doubtful virtues of the medicine should never have been invoked than that it should have been used with such destructive effects. There are acute inflammatory affections in which the danger to life is so imminent, and in which mercury has been so strongly and unqualifiedly praised by celebrated physicians, that one, even while holding it to be a doubtful remedy, can scarcely refuse its administration. Such affections are membranous laryngitis and acute meningitis. But even in these the qualifying conditions are numerous and important.

The question *how* it operates in inflammation is usually answered by a reference to its aplastic power. The great physical phenomenon of inflammation is an increase of the fibrin of the blood, and the tendency to form fibrino-albuminous effusions upon membranes, especially serous membranes, and in the parenchyma of the solid organs. Mercury cures these morbid effects of the inflammatory process, removing effusions, preventing adhesions, contractions, obstructions, etc., which tend to impair the activity and hinder the free play of the organs. We have seen how in animals and men subjected to the prolonged action of mercury the solids of the body lose their firmness and the blood its coagulability, and hence there is every reason to believe that a moderate action of the same substance will tend to remove the unorganized or imperfectly organized products of inflammation. It has been objected to this explanation that the constitutional mercurial action sometimes gives rise to the very plastic formations for which it is alleged to be an appropriate cure. And undoubtedly such is the case. Plastic exudations tend to occur whenever the proportion of fibrin in the blood is increased, whether it exceed the normal average while the proportion of red globules remains unchanged, or whether it is only relatively increased in consequence of the diminished proportion of red globules contained in the blood. Now, it is highly probable, judging from the pallid anæmic aspect of persons who have been thoroughly mercurialized, that their blood has undergone a diminution of its red corpuscles, and consequently there is a reason why such blood should present a buffy coat, like that which is observed under an analogous condition of the blood in pregnant females, and also why the effusion upon inflamed surfaces should assume a plastic form. Again, there are instances in which the primary constitutional action of mercury is to produce a decided erethism, a state of fever which very possibly may directly augment the proportion of fibrin in the blood. But such an effect is most probably an exceptional one in the degree alluded to, and the more ordinary form of this erethism partakes more of the nature of a nervous than of a true febrile affection. It is very much to be regretted that no analyses of the blood have been made which will permit us to distinguish between the operation of mercury and of

disease upon this fluid. These alone would enable us to decide the question what changes the former occasions in the blood. Its defibrinizing power appears to be established by all the phenomena above enumerated. And yet when, in the absence of direct experiment, we invoke the light of analogical reasoning, we are obliged to confess that the operation of mercury, as of all other specific medicines, is involved in obscurity. Scurvy is a disease which bears a very close resemblance in its symptoms to the constitutional effects of this medicine; nevertheless, in its acute form, with hemorrhage beneath the skin and from the mucous membranes, the proportion of red globules, of albumen, and of fibrin does not vary from the healthy standard.[1] To explain the phenomena of scurvy, and those also of mercurialization, it would seem probable that other causes besides the one referred to must be admitted. Is it a change that takes place in the vital properties of the blood? or one that affects the texture of the solids independently of the condition of the circulating fluid? or do both of these alterations concur to produce the phenomena which follow the administration of the medicine? But leaving these obscure inquiries, let us endeavor to learn in the treatment of what inflammatory diseases mercury has been found advantageous.

Inflammations of the Serous and Fibrous Tissues. Meningitis and Acute Hydrocephalus.—In cerebral disorders which occur as complications or as sequelæ of febrile, and especially of eruptive diseases, and which commence with the impairment or speedy abolition of the mental faculties, and of the senses of sight and hearing, or in which this condition follows rapidly upon a stage of febrile or nervous excitement, the disease is probably *hydrocephalus internus* produced by a serous condition of the blood, or by tubercles of the pia mater. In such cases, as well as in those more decided ones of tuberculous meningitis which are subacute and gradually developed, mercury can afford but little hope of permanent advantage, and might be suspected of tending to hasten the fatal termination. Yet the diagnosis of these forms of cerebral disease is not so well settled that we should be induced by any supposed accuracy of our conclusions to withhold almost the only medicine which appears to be materially useful in their management. Two of the earliest cases of the successful treatment of such affections by mercury were recorded by Dr. Leib, of Philadelphia, in 1788,[2] and another, in which the affection was of a less acute type, was soon afterwards cured by Dr. Rush.[3] A very similar instance occurred under the care of Dr. Chambers, of London, who has rendered it probable that even meningitis produced by tubercles may be cured by mercurial medicines.[4] But whenever a febrile affection, apparently of cerebral origin, is marked by convulsions in the forming stage, by severe pain in the head, by morbid susceptibility of the senses, and injec-

[1] BECQUEREL and RODIER, Chimie Pathologique, p. 141.
[2] Trans. Coll. Phys. of Phil., 1793, p. 49. [3] Ibid., p. 147.
[4] Lancet, April, 1858, p. 386.

tion of the face and eyes, there is reason to suppose that *meningitis* exists. In cases of this description, provided that the general state of the system does not forbid a debilitating treatment, mercury may be generally employed both as a purgative and for the purpose of producing its constitutional effects. With these objects in view, a full dose of calomel, followed by a saline or other purge fitted to produce copious stools, should be administered; subsequently divided doses of calomel should be given, and at the same time mercurial ointment rubbed into the thighs. Gölis, who has written very clearly upon this disease,[1] depended chiefly for its treatment upon calomel, given to children of from one to five months old in doses of one-quarter of a grain, and to those of from six months to two years of age, in doses of one grain every two hours, until it produced from four to six greenish, slimy stools. This treatment is not less appropriate to the disease when it occurs in adults. Mercurial purges may be used with great advantage in the first stage; and subsequently, when the excitement has declined, and there is a tendency rather to oppression of the faculties and coma, fractional doses of calomel should be administered, so as to produce, if possible, the characteristic effects of the medicine upon the gums.

Pericarditis.—"If," says Graves, "a person is seized with very acute pericarditis, how unavailing will be our best directed efforts unless they be succeeded by a speedy mercurialization of the system," and Dr. Stokes subscribes to this doctrine, advocating the exhibition of twenty grain doses of calomel, once or twice daily.[2] On the other hand, Dr. Markham, one of the most intelligent writers on diseases of the heart, concludes from his experience that "the actual influence which the remedy possesses over the disease has yet to be shown."[3] While to Dr. Fuller "it is obvious that no case of pericarditis occurring in a strong and healthy person, can be safely treated without mercury."[4] In 1862 Dr. Walshe thought "it must be conceded that any precise evidence before the profession fails to demonstrate the alleged prowess of the mineral;"[5] and in 1873, the same eminent authority said, "I must admit that year by year my faith in mercury has waxed less strong, and that a long period has elapsed since I have even made a deliberate attempt to salivate a pericarditic patient."[6] To the latter of these judgments we adhere. There can be no doubt that acute, primary, and idiopathic pericarditis tends generally to cure without the intervention of any active remedies, and hence the practice of prescribing mercurials in such cases can hardly be justified. How far they are required in the rheumatic form of the disease, and in those subacute and chronic varieties of the affection which either do not tend spontaneously to cure, or are likely to terminate in adhesion of the heart and pericardium together, is still an open question, but one in which

[1] A Treatise on Hydrocephalus Acutus, Trans. by GOOCH, p. 110.
[2] Diseases of the Heart and Aorta, p. 86.
[3] Diseases of the Heart, p. 98.
[4] Diseases of the Chest (1862), p. 535.
[5] Diseases of the Heart, etc. (1862), p. 236.
[6] Ibid. (1873), p. 240.

we should adopt the affirmative if at all, upon theoretical rather than upon clinical grounds, and under the conviction that whatever temporary inconvenience may ensue from mercurialization, still greater must result from the adhesions referred to, and, therefore, that so grave a consequence should be averted by every available means. If, then, the attack be one of rheumatic origin and a sthenic type, or if in other cases the physical signs denote a persistence of the effusion despite of other local and general remedies, mercury should be prescribed, and cautiously persisted in until its constitutional effects are developed, and have been mildly sustained for a reasonable time.

In *endocarditis*, the real value of mercury remains to be demonstrated, and, indeed, since the introduction of alkalies into the prophylactic and medicinal treatment of this disease, the question has possessed only a subordinate interest. It may be of interest to hear the opinion of Dr. Walshe upon this point. "I confess," says Dr. W., "I have never had satisfactory proof either from observation or reading, that lavish bloodletting and mercurialization really stay the course, or remove the proceeds, of the inflammation-process in this locality." In acute *pleurisy* mercurials are unnecessary as a general rule, and we can hardly appreciate the propriety of using them. It is right to say, however, that some physicians of high authority are of the contrary opinion. Thus Dr. Walshe at one time considered them as not inferior in importance to bloodletting, and used them both internally and by inunction until a slight amount of mercurialization was produced. A similar practice, but even more energetic, was prescribed by Dr. Fuller. In the subacute and chronic forms, a gentle action upon the gums is said to be often attended with a simultaneous subsidence of the effusion.

Peritonitis.—In *puerperal peritonitis* mercury has been highly lauded by Chaussier, Laennec, Baudelocque, Velpeau, Gooch, Churchill, and others. Velpeau used inunctions upon the abdomen with two or three drachms of mercurial ointment every two hours, and at like intervals administered two grains of calomel. By this treatment combined with moderate bloodletting, we are assured that he saved fourteen out of the nineteen cases in which it was tried, whereas he cured but four out of sixty cases treated by bloodletting alone.[1] Dr. Meigs, on the other hand, refused it all confidence, and put his sole trust in the lancet.[2] Canstatt declares that mercurials are of *as little use as depletion* in this disease;[3] he adds, however, the qualifying statement, that if our expectations of their curative powers are not extravagant, we may place them in the first rank of those few remedies upon which some dependence is to be placed. The probability is that the cases of puerperal peritonitis adapted to the use of mercurials are the same that can bear depletion, while those which more properly belong to

[1] Archives Gén., xix. 535. [2] On Childbed Fevers, p. 289.
[3] Klinik, iv. 1003.

the category of puerperal *fever*, and which involve a greater or less diminution of the coagulability of the blood, are with still more certainty unfit either for depletion or mercurialization.

Rheumatism.—Of all the remedies which can be used in *acute* rheumatism, none is entitled to less confidence than this. It exerts no control over the disease itself, and if pushed to the extent of making the mouth sore, is apt to occasion great debility and exhaustion. It does not prevent the occurrence of the serous inflammations which often complicate rheumatism, but it does, by prematurely occupying the ground, deprive the physician of a resource against these inflammations, when they are actually developed. Yet it is proper to state that Hamilton, Hope, and J. Johnson, advocated the mercurial practice in this disease, while Dr. Copland's opinion resembles that which we have above expressed. In the *subacute* and *chronic* forms of the affection a very gentle and sustained mercurial action will sometimes put an end to the lingering stiffness of the joints, the persistent thickening of the ligaments, the periosteal swellings, and the muscular and neuralgic pains which become particularly severe during damp weather. For this purpose very minute doses of the bichloride, in syrup of sarsaparilla, will be found most appropriate.

Inflammations of the Parenchymatous Organs. Pneumonia.—Since it has been ascertained that in the great majority of cases simple acute pneumonia does not require active treatment, the use of mercurials in this affection has greatly diminished. Dr. Walshe says: "Mercurials appear to me to be desirable in those cases of pneumonia only where, for some cause or other, antimony is inadmissible;"[1] an opinion which, it is probable, he has fundamentally modified. Grisolle, in his classical work on this disease, describes its treatment by calomel and opium as a method employed by English physicians, but adds that he has never seen it used, or resorted to it himself, and, indeed, would not venture to employ it.[2] In France, generally, and also in Germany, mercury is seldom used in the cure of pneumonia except as a purgative. Among English and American physicians it is more commonly employed, but of late less extensively than in former times. It is possible that mercury may display in cases of rapid and general hepatization a virtue which it does not in the ordinary forms of the disease. But we cannot forget that such cases precisely we have known to get well with resolution without any medicine at all. Dr. West recommends it in those cases among children where the symptoms are not violent enough to require very large doses of antimony, or where the stage for administering this medicine advantageously has passed by. In graver cases, attended with bronchial respiration, he advises it in addition to depletion and tartar emetic.[3] Dr. J. F. Meigs uses it sparingly and seldom;[4] and Rilliet and Barthez

[1] Diseases of the Lungs, etc., 2d ed., p. 436.
[2] Traité Pratique de la Pneumonie, p. 678.
[3] Diseases of Infants, p 270. [4] Diseases of Children, 2d ed., p. 171.

look upon it as unnecessary, in the primary as well as in the secondary forms of the disease, as it occurs in children. Since the opinions which have been quoted were expressed, a radical change of sentiment has taken place, and it would now (1874) probably be difficult to discover a single physician of recognized judgment who prescribes mercury for any purpose whatever in acute pneumonia.

Acute Hepatitis.—According to Annesley,[1] next to local and general depletion calomel should be employed, but only as a purgative and with anxious care to avoid its constitutional effects, the latter tending to impair the vital energies and to keep up the excitement and irritative action of the inflamed parts. Twining's precept agreed with this in substance. He recommended ten grains of calomel with six of the compound extract of colocynth and four of extract of hyoscyamus to be given every night, followed the next morning by the compound powder of jalap or the infusion of senna with salts, and the daily inunction of half a drachm of camphorated mercurial ointment upon the right hypochondrium.[2] Sir J. R. Martin[3] thus explains the virtues which he attributes to mercury "in all the more acute hepatic affections of India." "It is, in fact, by this very double action of purging and increasing secretion at the same time that calomel relieves the loaded and inactive vessels of the diseased gland, not to speak of the other acknowledged physiological influences of the mineral, such as its increase of all the secretions and excretions of the body; its influence on the capillary circulation; its febrifuge effect; the peculiar specific power attributed to it by physicians and surgeons as an antagonist to inflammations, whether general or local; its stimulant power over the absorbent functions; its power of unloading at the same time that it gives a new impulse to the vascular system; its peculiar power in removing viscid and tenacious intestinal secretions; its antiphlogistic, solvent, and alterative effects on the blood—these are the actions and uses ascribed to mercury by the ablest British practitioners and authors, and they are such as to place this remedy second only in order of importance to bloodletting in all the more acute hepatic affections of India." Dr. Morehead, taking a similar view of the action of the medicine, advises it to be given essentially after the manner of Annesley and Twining.[4] He says: "Its usefulness and the propriety of repeating it once or twice will be in proportion to the sthenic state of the constitution, the recency of the attack, and the evidence of coexisting sluggish movement of the portal blood, with a deranged state of the biliary secretion. And what are the evidences of these derangements? 1st. A yellow-coated state of the tongue, there being no irritation of the mucous lining of the mouth to account for it. 2d. Scanty alvine discharges, whether dark or pale. 3d. General fulness of the upper part of the abdomen, with, it may be, the physical signs of liver

[1] Diseases of India, p. 423. [2] Diseases of the Liver and Spleen, i. 251-2.
[3] See his edition of Johnson's work on The Influence of Tropical Climates, 1856, p. 267.
[4] General Researches on Diseases in India, ii. 74.

enlargement. 4th. A dingy state of the skin and scanty, high-colored urine." These indications are likely to be present only during the early stages of the disease and in systems well supplied with blood. In advanced stages and in cachectic constitutions the means recommended are no longer applicable; among the objections to them is their tendency to excite dysentery, and, as a further consequence, abscess of the liver. The caution required in the administration of mercury with a view to its constitutional action of hepatitis is shown by all experience to be very great, at least in warm climates. The repeated use of this medicine is known to induce a permanent derangement of the hepatic function, with disordered digestion and impaired general health, and, in the opinion of many, promotes the development of hepatic abscess;[1] hence it appears now to be established as a rule of practice to administer no more of it than is necessary to produce slight ptyalism, during the early stages of the disease alone, and provided that depletion and purgation have failed to subdue the symptoms. If abscess of the liver should occur, or seem to be threatening, the further use of mercury in any form is contraindicated. When abscess already exists, most writers agree that it is a matter of great difficulty to bring the system under the mercurial influence.

Chronic Hepatitis.—In this affection, when the liver is enlarged, tender upon pressure, sometimes indurated, and its secretion scanty, it is usual to administer mercury both as a purgative and for its constitutional effects. But such treatment will only aggravate the disease, unless it be purely of inflammatory origin. Supposing this to be determined, great circumspection must be observed in the use of the remedy, and, if persisted in, other appropriate means should be conjoined with it to sustain the strength and give activity to the functions of the skin, intestine, and kidneys.

Chronic Functional Derangement of the Liver, attended with "a muddy or yellowish cast of countenance, a heavy expression of the eye, and a dirty yellow tinge of the tunica albuginea, pale or dark and offensive stools, epigastric oppression and fulness, loss of flesh and strength, a feeble pulse, and depressed spirits," were treated by Annesley and by his numerous imitators with calomel at night and a purgative draught in the morning until the stools assumed a healthy appearance, when blue pill at night and a laxative in the morning were substituted for the stronger medicines, to be in their turn followed by tonics. So far as the symptoms above detailed denote functional disorder of the liver, it may be asked whether the repeated administration of mercurial purges was necessary for their removal? The treatment by these agents is almost exclusively confined to British physicians and their imitators in this country, with too many of whom derangement of the liver, whether by excess or deficiency of secretion, is habitually treated with mercury, as if this medicine were endowed with a special power of righting all the wrongs that can afflict the biliary organs. This

[1] WARING, On Abscesses in the Liver, Trevandrum, 1854, p. 200.

irrational system has been reprobated in terms of just severity by several writers, among whom Saunders, Abercrombie, Holland, and Thomson may be mentioned. Even Mr. Twining pointed out the absurdity, in cases of jaundice supposed to depend upon obstruction of the common duct of the liver, of giving a medicine whose operation is presumed to consist in exciting the secretion of bile. Dr. Prout compares the habit of taking mercury for supposed torpor of the liver to the habit of dram drinking. As the stomach accustomed to ardent spirits will scarcely tolerate any weaker beverage, so the liver accustomed to the stimulus of mercury will hardly respond to any other influence.[1] The habit of taking mercury occasions biliary attacks or hepatic congestions, renders liable to catching cold on slight exposure, and sometimes is the immediate cause of developing phthisis. Dr. Prout goes so far as to say that a large proportion of the most inveterate dyspeptic and urinary diseases which he had seen were distinctly referable to the abuse of mercury. In the greater number of chronic affections of the assimilating organs, if the patient has not been accustomed to mercury, he will recover quite as well without it. The affections are cured, at the least, as perfectly in France and Germany without mercury as they are in England and America by its means, or in spite of it.

Among the functional hepatic derangements to which the preceding remarks apply, is that disorder known as a *bilious attack*, and which presents more or less of the following symptoms, viz.: nausea, headache, foul tongue, a bitter taste in the mouth, bilious diarrhœa, a muddy or even yellowish complexion, and some fever. For these symptoms it is customary to prescribe brisk purging and calomel and salts, but it is probable that the latter medicine alone would be amply sufficient. The same may be said of that *increased secretion of bile* which is apt to occur in those who are becoming acclimated in warm latitudes, and which is also met with, to some extent, during the hot summers of even the middle portions of the United States. *Defective secretion or excretion of bile* is a more frequent derangement, which, besides depending upon various organic diseases of the liver and adjacent organs, may arise from functional derangement. But, so far as hepatic secretion is concerned, this is much more generally diminished under the influence of general than of local causes, and very often in consequence of the double operation of an anæmic condition of the system, and such abstinence from nutritious food as leaves the liver without its normal stimulus to secretion. Under such circumstances, mercury is contraindicated. But even when constitutional defects cannot explain the apparent absence of bile in the dejections, the use of mercury is still to be sparingly resorted to for its restoration. "Its frequent use, in any case, may lead to much mischief. When the liver has been accustomed to the stimulus of mercury, no other medicine will sufficiently excite its action. The person is thus led to the habitual use of the medicine, and, after a time, the constitution is under-

[1] Stomach and Renal Diseases, 4th ed., p. 54.

mined by it. . . . It increases the activity of the liver, at first, but seems to leave it weaker than before, and if frequently resorted to, the nutrition of the patient, impaired by the original disease, is still further impaired by the drug."[1] In all such cases, the best medicine of its class is taraxacum, alone, or in conjunction with nitro-muriatic acid.

Jaundice.—It is to be supposed, in the present state of our knowledge, that jaundice depends either upon some impediment to the flow of bile into the duodenum, or to its defective secretion. Over the latter, mercury is not proved to exert a favorable influence. The former condition, in so far as the obstacle is purely mechanical, such as a gall-stone, a tumor, closure of the duct, or the like, is equally beyond the power of this medicine, but where it is produced by a congested state of the liver, and the object is to unload the portal circulation, depletion and saline purgatives are preferable to calomel. But if, in spite of these remedies, the symptoms are not wholly removed, mercurial purges should be added to the treatment, and small doses of blue pill with aloes or rhubarb, given so as very gently to maintain an action upon the bowels.

Chronic Enlargement of the Spleen.—Twining noticed that patients who are suffering from this affection are generally liable to be affected in the most unfavorable manner by mercury; the immediate effects being profuse salivation and destruction of the soft tissues of the mouth followed by caries, and the remoter consequence being permanently injured health, or a broken and ruined constitution.[2] This singular susceptibility renders the duty imperative to abstain from the administration of mercury in cases of hepatic disease complicated with enlargement of the spleen. The same evil influence had been noticed by earlier observers. Dr. Crane, who practised in the fens of Lincolnshire, says: "Mercury does not appear to be at all beneficial in enlargement of the spleen."[3] Dr. Vetch, also, speaking of this affection, remarks that any continued course of mercury renders the patient less capable of regaining that general tone of the system, the want of which forms the principal obstacle to his recovery.[4] Leue, of Berlin, called attention to this peculiarity in 1825; and, just before, Abercrombie remarked that attempts to reduce chronic enlargements of the spleen by mercury are generally followed by the worst consequences.[5] Mr. Henderson, in his observations on the diseases of natives of Hindostan, says that in enlargement of the spleen, mercury easily produces ptyalism to an alarming extent, and so readily that gangrene and death have been the result of a few doses of blue pill.[6] Finally, Mr. Martin remarks that mercurial remedies in enlargement of the spleen and its coexisting cachexia, are distinctly and grievously injurious, and that they should never be used.[7] This cachectic and anæmic con-

[1] BUDD, Diseases of the Liver, p. 266. [2] Diseases of Bengal, i. 452.
[3] Edinb. Med. and Surg. Journ., April, 1823, p. 245.
[4] Lond. Med. and Phys. Journ., ii. 445.
[5] Edinb. Med. and Surg. Journ., April, 1824, p. 9.
[6] Ibid., July, 1825, p. 34. [7] Op. cit., i. 71.

dition of the system should be treated by tonics, and particularly cinchona and iron. On the other hand, Prof. Maclean asserts that the application of an ointment of biniodide of mercury over the left hypochondrium is nearly as useful as the similar treatment of goitre described in the next paragraph. He found it very successful in the R. V. Hospital, Netley, in the treatment of enlarged spleens and livers, substituting the heat of a fire for that of an Indian sun. In some cases where the spleen extended down to the pelvis, it was, after several applications, reduced almost to its normal limits; and in only a few cases did the treatment fail to reduce the size of the organ signally. It acted just as energetically on enlarged malarial livers.[1] Dr. Balfour has published an illustrative case.[2]

A curious statement has been made respecting the virtues of biniodide of mercury in *goitre*. It appears that this affection is extremely prevalent in Bengal, and not less than 60,000 persons are said to have been treated according to the method of Captain Cunningham, with scarcely a case of ill success. An ointment prepared with three pounds of lard, and nine drachms of biniodide of mercury, was applied to the goitre, and rubbed in for about ten minutes. This operation was performed early in the morning, and the patient was obliged to remain with his goitre exposed to the sun the whole of the day, if he could bear it so long. About two o'clock in the afternoon, a second application of the ointment was made very tenderly, and the patient dismissed with the injunction on no account to remove any of it until after the third day. This treatment is stated to be quite sufficient for an ordinary cure.[3] These remarkably successful results have been confirmed by the equally beneficial effects of the treatment of upwards of 20,000 cases, as reported by Dr. Macnamara, of the Bengal army.

Dr. John S. Parry, of Philadelphia, informs us that in several cases of *chronic rheumatic arthritis* he has seen the most signal benefits follow upon a similar treatment of the affected joints. If further observation should confirm these results, the suggestion of the method will prove extremely valuable, for hitherto no treatment whatever can be said to have made much impression upon this painful and crippling disease.

In *nephritis* there is no especial indication for mercurials. They are used as other laxatives are to keep the bowels free, but with no particular advantage except over the neutral salts, which render the urine more irritating. Mercurial inunction of the loins has been recommended, but its value is not determined. In *albuminuria* and *diabetes* the use of mercury is sedulously to be avoided. In *metritis*, both of the acute and chronic forms, but in the latter more especially, calomel and opium are sometimes resorted to with advantage. Allusion is not here made to the puerperal form of the disease, which is usually complicated with peritonitis, and which

[1] REYNOLD's System of Medicine, i. 68.
[2] Edinb. Med. Journ., xvii. 647.
[3] Dublin Quart. Journ., Nov. 1857, p. 500.

has been elsewhere discussed in reference to the mercurial treatment.

Iritis.—This disease is usually taken to illustrate the antiplastic effects of mercury. The fibrinous effusion is often visible in the affected eye, and its rapid subsidence under the action of mercury can be distinctly traced. This is strikingly the case in the rheumatic and much more so in the syphilitic forms of iritis. A caution is to be given as to the former, that the mercurial impression, directly favorable as it is, exposes the patient to relapse by increasing his susceptibility to cold, already exalted by the rheumatism. The dose usually prescribed is from one to two grains of calomel, with a quarter of a grain of opium, every six hours, until some slight impression is made upon the mouth. In syphilitic iritis it is generally necessary to carry the mercurial action further. At the same time mercurial ointment, with extract of belladonna, may be rubbed around the orbit, morning and evening. Or, as advised by Mr. Teale, a broad piece of flannel, well smeared with mercurial ointment, may be wrapped around each arm of the patient, and worn until the gums are slightly tender. A small quantity of fresh ointment should be added daily. In gouty and in scrofulous iritis, mercury must be more cautiously employed, and generally in conjunction with other remedies, tending, in the former case to eliminate the gouty matter from the system, and in the other, to fortify the constitution by tonics, and especially by bark and iron. Owing to the favorable influence of mercury on iritis being so plainly manifested, the medicine has come to be regarded as a specific without which iritis cannot be cured. But some proof of the contrary was produced by Dr. H. W. Williams, of Boston, who reported sixty-four cases, including idiopathic, traumatic, rheumatic, and syphilitic iritis, cured without mercury.[1] A review of the report, while it shows that iritis may in the majority of cases get well without mercury, leaves also upon the mind a distinct impression that in nearly all the cure will be hastened and perfected by this medicine. Indeed later observations appear to demonstrate that mercury has a special curative power in the treatment of syphilitic iritis, while other forms of that affection may be cured as well or even better by other remedies.

Inflammation of the Mucous Membranes.—Whether or not it be owing to the belief, so generally entertained, that the antiphlogistic powers of mercury depend upon its aplastic operation, and hence that it is inappropriate to the cure of all inflammations which do not tend to fibrinous effusion, the fact is that in practice it is seldem employed, except as a purge, in inflammations of the mucous membrane which are not of the pseudomembranous form. To these the following remarks will be chiefly applied.

Croup, or Pseudomembranous Laryngitis.—According to Cadwalader Colden,[2] "dulcified mercury" was used as early as 1736, by

[1] Boston Med. and Surg. Journ., Aug. 1856, pp. 49, 69, 92.
[2] Med. Obs. and Inq., i. 211.

Dr. Douglas, of Boston, in a "throat distemper," which, from the description, appears to have been pseudomembranous inflammation of the pharynx and larynx. But this physician does not seem to have attached much importance to it in comparison with gentle diaphoretics. Dr. Bard, of New York, was the first to use *calomel* in croup, during an epidemic of the disease in 1771. Currie states that it was employed by Dr. Thomas Bond, and several other American physicians, as early as the year 1772, in the malignant sore throat.[1] A few years afterwards (1781), Dr. Bayley, of New York, used it with advantage in the same disease, although he depended more upon bloodletting and emetics. Currie, who wrote in 1811, remarks that he conceives the mercury to act by causing the false membrane to be detached, so that it is more readily expelled by coughing, or by means of emetics, which he recommends to be given for this purpose. And thus, in a few words, he expressed, as we believe, the whole doctrine of the utility of mercurials in croup. The remedy was also strongly recommended by Kuhn, Redman, Stearns,[2] Hosack,[3] and Physick.[4] From America the use of the remedy speedily extended to England, where it was particularly advised by Hamilton and Cheyne,[5] and to the continent of Europe, where it sustains its reputation even to the present time. In Germany its value was recognized by Albers,[6] Goelis,[7] Schenck,[8] Hufeland,[9] Autenreith, etc., and in France, by Bretonneau,[10] Billard, and more recently by Guersant.[11] Too generally the real indication for the use of this medicine in croup has been lost sight of, and it has been applied when the advanced stage of the disease has rendered it, at the least, unavailing. Even at the present day this method, which we believe erroneous, is the one generally recommended. Canstatt[12] refers to mercury as a remedy of only doubtful efficacy, and prescribes it after the failure of other means; and Dr. West remarks, it is "after the severity of the disease has been subdued by antimony, that the time has come for the administration of calomel." It is true that he also says, mercurial inunction may be had recourse to from the very commencement of the attack, but he adds, "The action of mercurials is far too slow to overtake a disease which tends so rapidly to a fatal issue."[13] We are persuaded that, however slow, it is still the most efficient auxiliary to the true remedies in this disease, viz., mechanical emetics, because, as Currie remarked, it alone can promote the loosening of the false membrane on which the danger mainly depends, and thus favor its rejection

[1] A View of the Diseases, etc., p. 109.
[2] COXE's Med. Museum, v. 195.
[3] Essays, ii. 159.
[4] RUSH's Works, ii. 227.
[5] Pathol. of the Membrane of the Larnyx and Trachea, p. 46.
[6] Comment. de Tracheitide, p. 122; Path. u. Ther. der. Kehlkopfskrankheiten, p. 86.
[7] Tractatus de Angin Memb. (1813), p. 114.
[8] VALENTIN, Recherches sur le Croup, p. 607.
[9] Enchiridion Med., art. Croup.
[10] RILLIET and BARTHEZ, Mal. des Enfants, i. 352.
[11] Dict. de Méd., ix. 374.
[12] Med. Klinik., iii. 2, p. 78.
[13] Diseases of Infants, etc., 3d ed., p. 299.

by the operation of emetics, or by coughing. This view of its mode of action was also entertained by Bretonneau and by Albers. It is, moreover, possible that the defibrinizing action of the remedy upon the blood may limit, and even arrest, the formation of false membrane. On every ground, therefore, it appears to be urgent that the system should be brought under the mercurial influence as early as possible both by inunction and by the internal use of calomel. Certainly, it must not be concealed that in feeble and cachectic children, there is a danger of producing ulceration of the mouth, and general debility, if too large doses are employed. In these cases, therefore, it should be withheld. It is highly probable, also, that the method is vastly more efficient in rural districts than in large towns. It is usually prudent not to exceed the dose of half a grain of calomel every hour, for children under two years of age, nor of one grain every hour, for those beyond this age, until twenty or thirty grains are taken. This was the method of Albers. Twenty grains of mercurial ointment may also be rubbed into the thighs, or the sides of the chest, two or three times a day. Bretonneau employed much larger doses of mercury than these, viz., four grains of calomel every hour, and thirty grains of mercurial ointment, by friction, every three hours.

The *subsulphate of mercury*, or *turpeth mineral*; which is employed in France as an emetic for quadrupeds, has been recommended by Dr. Hubbard as a remedy for *spasmodic croup*. He advised that two or three grains of the powder be given to a child two years old, and repeated every ten or fifteen minutes until emesis takes place. It acts promptly and maintains its action for an hour or longer. Dr. H. thought that it was more active than ipecacuanha, and safer than antimony, inasmuch as it does not produce as great prostration as the latter, and seldom acts upon the bowels. He never knew it to operate violently or to produce salivation.[1] It is nevertheless capable of producing poisonous and even fatal effects.[2]

In cases of *simple acute laryngitis*, when the symptoms are of a high grade, it may be prudent to administer mercurials, first as purgatives, and afterwards in divided doses, and in combination with tartar emetic and opium. But the chief resource in this case is bloodletting. Mercury is a highly important remedy in *ulcerative laryngitis* of syphilitic origin. Theoretically, it would also appear to be indicated in *plastic bronchitis;* but there is no clinical evidence of its utility in this affection.

Dysentery.—The benefits of mercurials in this affection are said to have been first pointed out by Pringle, in 1768, since which time they have been highly esteemed by McGrigor, J. Johnson, Ferguson, Bampfield, Ainslie, Latham, and other British practitioners, some of whom practised at home, but others had met with the disease in tropical climates. The latter employed very large and repeated purgative doses of calomel, while the former, for the

[1] BRAITHWAITE'S Retros., xiv. 134.
[2] Vid. supra; also GMELIN, Apparat. Med., Part II. vol. ii. p. 177.

most part, relied upon the alterative operation of the medicine. The treatment of dysentery by large and repeated doses of calomel appears to have originated with Ainslie.[1] In the first stage of the disease he gave scruple doses of it at night, and a cathartic draught on the following morning. His *theory* was that the restoration of bile to the fæcal discharges tended to remove the disease. Whether the practice in itself did more harm or good, cannot be inferred from his statements, since along with this already active treatment he often exhibited, three or four times a day, three grains of calomel with as much ipecacuanha, and one grain of opium, besides using general and topical bleeding, warm hip-baths, poultices to the abdomen, and small anodyne and emollient enemata. This treatment, we are told, does not at present find much acceptance in practice in any part of India, but has fallen into disuse;[2] but we learn from the same authority, that the proper treatment of acute dysentery during the first two or three days of the disease, and in persons of good constitution, consists—after bloodletting—in giving, at bedtime, ten grains of calomel with one or two grains of ipecacuanha, and the same quantity of opium, to be followed the next morning by one or two tablespoonfuls of castor oil. These medicines are to be repeated twice or thrice if necessary. Essentially the same rules are laid down by Martin, as they had originally been by Johnson.[3] Morehead and Martin both deprecate the induction of the mercurial influence in dysentery, and inform us that, "as a rule of practice in India, it has been generally and certainly most properly abandoned." It is possible that time may work a still further revolution in the views of East Indian practitioners upon this subject. This change of sentiment was foreshadowed long ago by Mr. Twining, who used the following language: "Notwithstanding all that has been written in praise of the general employment of large and repeated doses of calomel, in the dysentery of India, whether that medicine be used to the extent of producing salivation or not; it will be easy to show that calomel is often not only useless, but that in many cases of the dysentery of Bengal, it is exceedingly injurious. I speak without hesitation on this subject, from having too often seen the fallacy of trusting generally to the effects of calomel, for the cure of the severe forms of acute dysentery; and having tried that medicine extensively in every stage of the disease."[4]

In the more temperate climates of the West the treatment by large and repeated doses of calomel at one time found numerous imitators, but among recent writers few of note are to be found as its advocates. An exception, perhaps, occurs in the case of Canstatt, who asserts, upon the ground of direct experience, that mercury is one of the most powerful remedies for dysentery, often rapidly ameliorating or notably shortening its attack. He prefers

[1] Diseases of India, p. 434 et seq. [2] MOREHEAD, op. cit., i. 556.
[3] The Influence of Tropical Climates, 1856, p. 284 et seq.
[4] Diseases of Bengal, 2d ed., i. 100.

giving doses of ten or twenty grains once or twice a day, repeated two or three times if the tenesmus and bloody stools continue.[1] A French army physician, Dr. Cambay, furnishes an interesting account of his experience with this treatment in Algeria, and concludes by stating that having employed it successfully in about two hundred cases, he reposes great confidence in it, and advises practitioners in hot climates to adopt it.[2]

In reference to the use of fractional or small doses of mercury in the treatment of dysentery, we find that Mr. Fergusson, in the Peninsular campaigns of 1809, employed with great success half-grain doses of calomel, with a grain of ipecacuanha in each powder, every hour until the mouth became sore. This treatment was successful, not so much in mild cases which a slight purgative or an active diaphoretic sufficed to terminate, but in attacks which began with urgent and violent symptoms. He employed no opium, but expressly avoided its use on finding that it counteracted the benefits of the mercurial.[3] A similar practice was adopted, with equally favorable results, by Dr. Mayne, of Dublin.[4] Sir James McGrigor found mercury of especial service in dysentery when there existed a diseased action of the biliary system, particularly the obscure symptoms of chronic hepatitis, which, he declares, mercury never fails to cure, or at least relieve, where the disease tends to become chronic, and when it is complicated "with obstruction of the mesenteric glands." In all cases of the acute form he preceded the special treatment with depletion, both local and general, after which, or without it in the less acute cases, he directed small doses of calomel and opium to be given, or mercurial inunction to be employed, until the mouth became slightly affected.[5] Illustrations of the same views might be multiplied; but it is unnecessary, after presenting those which show that the remedy is deserving of a certain degree of confidence, to do more than remark that dysentery is a disease curable by a great variety of methods, which become appropriate or the reverse according to the epidemic constitution and the peculiarities of the patient himself, and that as a general rule, applicable in all climates, the mildest treatment of the disease will usually prove the most successful.

Epidemic Cholera.—Ainslie[6] gave a scruple of calomel, with two grains of opium, at the commencement of the attack, and repeated the dose in six or eight hours, and again upon the following day. In the decline of the disease he ordered scruple doses of calomel for the removal of "cream-colored, thick, viscid, and tenacious matter exactly like cream cheese, which glues the gut together, and obstructs its passage." Three, four, and even five scruples of calomel were usually taken before this effect was produced. When it is added that this practitioner held depletion to be the capital element of the treatment, and that he was equally lavish of his patient's blood and

[1] Med. Klinik, ii. 499.
[2] De la Dyssenterie (1847), p. 572.
[3] Med.-Chir. Trans., ii. 180.
[4] Dublin Quart. Journ., vii. 303.
[5] Med.-Chir. Trans., vi. 430.
[6] Op cit., p. 187.

his own calomel, we can only wonder that any subjects of his heroic plan survived. A late writer on diseases in India omits nearly all allusion to this extraordinary method, and even speaks of his having formerly used moderate doses of blue pill as a work of supererogation.[1] It is now conceded that mercurials, in their ordinary mode of exhibition, are less than worthless in epidemic cholera; but there is another method, proposed by Dr. Ayre, of Hull, in 1832, and to which he always adhered. It consists in administering one or two grains of calomel every five or ten minutes, and in perseveringly continuing the same dose at the same intervals of time. One or two drops of laudanum are given with each of the first few doses of calomel. Certainly the apparent results of this method are more favorable than those of any other. In the reports of the London College of Physicians its success was rated much lower than it should have been, in consequence of its results being confounded with those in which calomel was used in larger doses, or at longer intervals, or associated with opium, with stimulants, etc. In a disease of such formidable symptoms as cholera there is strong temptation to use vigorous treatment, and a great deal of it, and hence the simple method of Dr. Ayre has been less generally employed than its apparent success entitles it to be.[2] We say apparent designedly; for it is impossible to resist the impression made by reading cholera Reports that the mortality has generally been proportioned to the "vigor" of the treatment.

Intestinal Worms.—It has been remarked elsewhere that mercurial vapors are generally fatal to insects and other organisms of a low grade, and hence, probably, has arisen the belief that mercury is adapted to destroy intestinal worms. But, as Brera remarked, the workers in quicksilver at Almaden, Idria, Chemnitz, and Freiburg are peculiarly subject to verminous complaints.[3] It is true, on the other hand, that lumbricoid worms, and also ascarides, are sometimes voided and permanently removed during a course of mercury.[4] Dr. Rush styled calomel "a safe and powerful anthelmintic," but remarked that, to be effectual, it must be given in large doses.[5] The usual mode of administering it is in association with jalap. One of the best and most certain cures for ascarides of the rectum is to introduce into the bowel daily, at bedtime, a small portion of mercurial ointment. A solution of the bichloride of mercury (gr. ¼ to gr. j in four fluidounces of water), used as an enema, answers the same purpose.

Metallic Mercury in Ileus.—In 1853 a Tuscan physician, Franceschini by name, published a memoir advocating the use of metallic mercury in obstruction of the bowels. Certainly he showed that

[1] MOREHEAD, op. cit. i. 412.

[2] Compare Reports on Epidemic Cholera, by Drs. BALY and GULL, Lond. 1854; and Letters from Dr. AYRE, Lancet, Oct. 1853, p. 321; Ibid., May. etc., 1854, pp. 536, 562, 591; Oct., p. 311; SHEARMAN, ibid., June, 1854, p. 651; TAYLOR, Aug. 1854, p. 167.

[3] On Verminous Diseases, by J. G. COFFIN, p. 212.

[4] OESTERLEN, Heilmittellehre, p. 116.

[5] Med. Inq. and Obs., i. 213.

it succeeded in removing simple fæcal accumulations. From fourteen cases of its administration in various intestinal affections he concluded that it always arrests the vomiting attendant upon them, and that it never does harm by its local action, and never produces ptyalism. The quantity administered was between six and twelve ounces, in three or four doses, and in the course of five or six days.

Mercury was at one time proposed as a remedy for *tetanus*, but, as Mr. Curling shows, it has, on the whole, been disastrous instead of useful,[1] or, as Moseley remarks, it has "killed more than it has cured." In acute *lumbago* Graves strongly recommended the induction of mercurial sore mouth by the administration of small doses of calomel and morphia, when the usual antiphlogistic remedies had failed to give relief.[2] But iodide of potassium is to be preferred.[3]

External Use.—Besides the therapeutical applications of mercury as an internal medicine, which have been considered, there are many of a local and external sort, in which, for the most part, the mercurial acts as a stimulant, as an irritant, or even as an escharotic. The preparations of this nature are all super-salts. In some cases the milder forms of the medicine are used, on account of their supposed antiphlogistic action ; in some the specific power of mercury over the insects which infest the human body is invoked ; and, finally, in some others a local action upon the skin, and a general one upon the system, are obtained in certain diseases which affect the whole body, but have their chief manifestation in cutaneous eruptions.

Diseases of the Skin.—It has been stated in another place that mercury was first of all used in these affections, and it still constitutes a very important portion of their treatment. Rayer recommends for *psoriasis* an ointment of *calomel* (calomel ʒj, lard ℥j), which, he says, never produces salivation.[4] Gibert, on the other hand, declares that it often salivates, and therefore requires to be used cautiously.[5] This writer recommends a solution of fifteen grains of corrosive sublimate in a pint of water as a desiccative lotion when the skin is red and excoriated by chronic *eczema;* and

[1] A Treatise on Tetanus, p. 140. [2] Clinical Medicine, p. 865.

[3] Dr. Habershon enumerated "the special diseases in which mercury is injurious" as follows: 1. Strumous diseases. 2. Degenerative changes of advanced life. 3. Fever and exanthems. 4. Conditions consequent on exhaustion, mental or physical. 5. Passive congestions in states of weakness and loss of power. 6. Cancerous diseases. 7. Degeneration of the kidneys. 8. In diseases of the mucous membranes (bronchitis, dysentery, etc.) it is of very questionable utility. 9. In diseases called inflammatory, as of the membranes and substance of the brain, of the lungs and pleura, of the pericardium and peritoneum, in croup, etc. 10. In rheumatism. To balance this long catalogue of the demerits of mercury, Dr. H. states its advantages to consist: 1. In removing retained excretions from the bowels, liver, etc. 2. In its speedy and efficient purgative operation. 3. In its exciting the excretory organs in some forms of dropsy, and in bronchitis with embarrassed heart. 4. In syphilitic diseases. 5. In some forms of gastrodynia and irritability of the stomach. 6. Locally in some cutaneous diseases and chronic inflammations. Of this latter list the sole disease in which mercury is capable of effecting what no other treatment can, is syphilis.

[4] Bull. de Thérap., xxxii. 281. [5] Maladies de la Peau, p. 511.

as a discutient of the red spots and pustules of *couperose*, and of the papules of *lichen*. Mr. Paget uses a wash of the bichloride (gr. j to ℥j) for the removal of "*liver spots*" (chloasma). It should be applied to the whole affected surface once a day. Mr. P. declares that it nearly always removes the discoloration, and that promptly.[1]

Baths of corrosive sublimate, proposed first by Baumé, have been highly recommended by Wedekind, who directed half an ounce of corrosive sublimate and one of muriate of ammonia for a bath, particularly in cases of *syphilitic eruptions* of the skin. Rayer speaks of their efficacy as doubtful; but Trousseau[2] pronounces them to be wonderfully efficacious in non-syphilitic as well as in venereal eruptions. Besides their curative operation, he remarks, these baths exert important influences upon the skin, and indeed upon the whole system. At first they occasion heaviness of head, and often an irresistible tendency to sleep; sometimes a sense of constriction in the stomach, with slight colic, occasionally followed by vomiting and diarrhœa. These symptoms cease after the first few baths, and are sometimes succeeded by an eruption upon the skin of the lower extremities, resembling *lichen agrius*, and giving rise to itching and burning. A continuance of the baths is very apt to augment these symptoms. These statements show plainly that the efficacy of the baths does not depend entirely upon their local operation. The utility of mercurial vapors in the treatment of syphilis has already been pointed out.

Lotions of bichloride of mercury may be substituted for baths in diseases of a local character. Numerous specifics for eruptions of the face, which are sold by perfumers, contain this preparation. *Gowland's lotion* is one of the most celebrated of these; in it the excipient is an emulsion of sweet or bitter almonds.

Mr. Wardrop refers to a case in which a solution of corrosive sublimate was applied successfully to remove a *corn*.[3]

Ulcers, whether syphilitic or not, are often improved by mercurial dressings, when indolent, flabby, and in need of stimulation. For this purpose powdered calomel, white or red precipitate ointment, black or yellow wash, ointment of the nitrate of mercury, a solution of the pernitrate, etc., may be employed. Care must be taken lest by extent of surface or frequency of application, or, finally, by the strength of the preparation used, the constitution become affected. In some forms of skin disease which are obstinate by nature or by the accidents of the case, these preparations are often of signal service, e. g., *lupus* and very limited eruptions of *psoriasis*. In the treatment of *acne simplex* one of the best applications is a lotion containing a grain of corrosive sublimate to five or six ounces of water and a fluidrachm of alcohol or Cologne water. (*Rayer*.) M. Hardy used for the same affection an ointment composed of one part of protiodide of mercury to thirty parts of lard, and in the more chronic and obstinate forms an ointment

[1] Times and Gaz., 1853, ii. 501.
[2] Thérapeutique, 5ème éd., i. 229.
[3] Med. Chir. Trans., v. 140.

made with equal parts of the deutiodide of mercury and lard. The latter is, however, too caustic in its action, and even the former occasions smarting, and its application is followed in two or three days by exfoliation of the epidermis.[1] Dr. Fuller treats *favus* of the scalp by cutting the hair short, and after thoroughly washing the skin with soft soap twice a day, applying equal parts of "unguentum hydrargyri ammonio-chloridi," and unguentum picis liquidæ.[2] The *nitrate of mercury* has been much employed as a caustic in cases of *ulceration of the neck of the uterus*, by Eméry, Lisfranc, and Bennett.

The ointments of red oxide and of nitrate of mercury and other mercurial ointments and solutions, have been long and are still used in a great variety of *inflammations of the eyes*, whenever, indeed, the exterior of the organ requires stimulation to promote its cure. This indication is most usual in the various forms of chronic conjunctivitis, and of inflammation of the edges of the eyelids. Lotions are most commonly employed in the former and ointments in the latter affections. Great care is to be observed in duly proportioning the strength of the application to the sensibility of the part.

Simple *ozæna*, as well as that connected with the syphilitic or scrofulous cachexia, is benefited by mercurial applications, in the form of vapor from cinnabar, or of solutions of the bichloride, or, finally, as recommended by Trousseau, of powdered calomel and red precipitate. One part, by weight, of red precipitate, two of calomel, and six of finely-powdered sugar candy should be intimately mixed, and of this mixture a pinch may be snuffed seven or eight times a day. Dr. Dewees states that in a few instances of chronic *leucorrhœa*—the leucorrhœa of habit, as he terms it—he employed with advantage an injection containing two grains of corrosive sublimate to an ounce of water. It should be used, he says, but once a day for the first two or three days; then twice a day for an equal period; and afterwards three times a day until heat or other signs of irritation are perceived. This state should be maintained for a week or ten days, after which saturnine injections may be substituted.[3]

All chronic superficial *swellings* resulting from inflammation have their absorption hastened by mercurial medicines, especially by frictions made with mercurial ointment, or by the application of plaster of mercury, or of plaster of ammoniac with mercury. This treatment is particularly appropriate in glandular and other swellings arising from syphilitic infection. It is sometimes used, also, to promote the resolution of *chronic engorgement of the liver or spleen.*

Mercurial ointment has been employed with great advantage in the treatment of *paronychia*. It was first made use of in 1833[4] by Miquel, and more recently by Martin.[5] In 1843 the latter had

[1] Abeille Méd., xiv. 131.
[2] Times and Gaz., March, 1857, p. 263.
[3] Diseases of Females, 3d ed., p. 81.
[4] Bull. de Thérap., iv. 298.
[5] Month. Journ. of Med. Sci., June, 1846.

forty-three cases under treatment by the ordinary methods, and of these forty terminated in suppuration. In the following year he had forty-eight cases, which he treated by mercurial frictions, and of these twenty-seven were cured by resolution. The method of using the remedy is to rub the affected part every hour for five minutes with mercurial ointment, and in the intervals to keep it poulticed.

The use of mercurial ointment in *erysipelas* began in Paris about 1830, and has continued to be more or less in vogue until the present time. It was highly recommended by Serre d'Alais[1] in inflammation of the subcutaneous cellular tissue, and also of the skin. In 1835, Dr. McDowel, of Dublin, from his own experience, concluded it to be a most valuable remedy in erysipelas.[2] On the other hand, in a discussion before the French Academy of Medicine (June, 1837), several physicians expressed an opinion decidedly adverse to the belief that mercurial applications have power to limit the extent or control the course of erysipelas. Among those who maintained this doctrine were Lisfranc, Velpeau, and also Eméry, who stated that he had employed the treatment in sixty-eight cases, and always without success; and further, that among these cases salivation was produced six times. Most of those who have adopted the method in question are probably disposed to attribute to the ointment a controlling power, at least, over the non-phlegmonous forms of erysipelas. But if they will make such comparative experiments as those of Rayer, who, in erysipelas of the face, applied mercurial ointment to one side, and simple ointment to the other, they will find, as he did, that the disease declines neither more nor less quickly under the former application than under the latter. It certainly, in some degree, allays the burning pain, in virtue of its unctuous qualities, but it at the same time exposes the patient to the serious risk of salivation.

To Prevent Pitting in Smallpox.—The reader will perhaps be interested in a succinct narrative of the evidence upon which rests the belief that mercurial ointment or the mercurial plaster is able to prevent the disfigurement which is so often the consequence of this loathsome disease. The first account of the subject with which we are acquainted is contained in Zimmerman's *Treatise on Experience.*[3] "A lady who was salivated by a mercurial plaster, was afterwards attacked by smallpox, when her whole body was covered with pustules, except only that part on which the plaster had been applied. M. Malouin suggested whether, judging from this fact, it might not be possible to prevent the eruption in the same manner. The experiment has not yet been tried, but it has led to using a means of preserving the faces of females from the effects of smallpox. M. Roseen covered the face of one of his patients with mercurial plaster, and the eruption appeared everywhere but on the

[1] Bull. de Thérap., iii. 5. [2] Dublin Quart. Journ., vi. 184.
[3] Edit. de Le Febvre, 1797, liv. v. chap. ii.

face. M. J. Henry Sulzer has repeated the experiment at Winterthor with equal success."

The method does not, however, appear to have been generally adopted, probably owing to a certain degree of trouble which the constant adjustment of the plaster requires; yet it did not wholly fall into disuse. Wedekind says,[1] "it was long ago ascertained that mercurial plasters prevent the development of variolous pustules;"[2] and he states that he obtained a like result by frequently using a lotion of corrosive sublimate. In 1833, Serre d'Alais and Ferrier,[3] and soon afterwards Serres, of Paris, and Gariel,[4] demonstrated the abortive influence of mercurial plaster upon variolous pustules. The last-named physicians further showed that this property is not possessed by simple lead plaster. Sandras, in 1837, and Baudelocque, in 1838,[5] obtained similar results with the mercurial lead plaster.[6] The latter physician found that when the plaster was applied early, it entirely prevented the development of pustules; but, at a later period, it only produced induration of the pocks, or rendered the ulcers superficial.[7] In 1839, Briquet performed some interesting experiments to determine the degree of the mercurial influence. In the first place, he produced vesication or pustulation of the skin in non-variolous patients by means of cantharides, croton oil, and tartar emetic, and found that the mercurial plaster had no influence at all upon the condition of the skin. He then used it in cases of eczema, acne, erysipelas, and furuncle, with a like result. But when it was applied to vaccine punctures it prevented the formation of vesicles altogether, or else rendered their development imperfect or abortive.[8] Nonat still further confirmed these results by applying the compound mercurial plaster to the eruption on one thigh of a variolous patient, while on the opposite limb he placed a simple diachylon plaster. The latter produced no effect, but the pustules under the former were converted into solid tubercles, while the skin retained its natural color, and was neither swollen nor painful.[9] In 1841 Dr. Stewardson, of Philadelphia, who then had charge of the Smallpox Hospital, made some experiments to test the virtue of this remedy. He found that mercurial ointment spread upon thick muslin, so as to form a mask for the face, prevented, more or less, the maturation of the pustules, diminished the concomitant swelling and soreness, and rendered the resulting scars less distinct than when the eruption was left to pursue its natural course. These conclusions were demonstrated, in some cases, by applying the ointment to one side only of the

[1] Beiträge zur Erforschung, etc., 1830, p. 113.

[2] Dr. Graves met with a case in which a patient was covered with confluent variola, except upon the knee, which was enveloped in a mercurial plaster. (*Dublin Quar. Journ.*, Feb. 1850, p. 115.)

[3] Bull. de Thérap., v. 33.

[4] Ibid., ix. 295; Arch. Gén., 2ème sér., viii. 468.

[5] Bull. de Thérap., xiii. 132; 362.

[6] Emplâtre de Vigo. Vid. U. S. Dispens., 10th ed., p. 952.

[7] Bull. de Thérap., xv. 143.

[8] Ibid., xviii. 159.

[9] Gaz. Méd. de Paris, July, 1839, and Am. Journ. of Med. Sci., xxv. 451.

face.[1] M. Goblin (who claims to have proposed this method in 1832) is of opinion that mercurial ointment is more efficacious than mercurial plaster.[2]

In 1849 Champenois proposed a plan of applying the mercurial plaster which he had used successfully. The melted *Emplastrum de Vigo cum mercurio* was applied with a mop to all of the face except upon the edges of the eyelids, and over this was laid carded cotton or fine linen, and the whole was rendered compact by holding a heated iron near the surface of the mask. Under the nose and the mouth an additional band of linen was affixed so as to prevent a separation of the dressing by means of the discharges from these orifices.[3] Prof. Bennett, of Edinburgh, has reported two cases of smallpox in which he applied to the face mercurial ointment thickened with starch, and renewed from time to time. In neither case did any pitting of the face ensue, although one of the patients had the arms and shoulders deeply indented with pits.[4] The same physician afterwards[5] met with a case in which this mode of treatment produced excessive salivation; he was thence induced to employ a zinc plaster (carb. of zinc three parts; oxide of zinc one part; olive oil, enough to form a plaster), which he found quite successful. Délioux gave the preference to simple and repeated inunctions with mercurial ointment, commenced, if possible, before the umbilication of the pustules.[6] But more recently he recommended a solution which may be represented by a fluidounce of flexible collodion containing six grains of corrosive sublimate. He states that after having used it in hundreds of cases he found its direct operation uniformly favorable, and that no injurious influence was exerted upon the course of the disease.[7] Whatever mode is adopted of making the mercurial application, it should be borne in mind that all of the bed and body linen which it touches will become indelibly stained.

In *prurigo pudendi* lotions containing corrosive sublimate, or inunctions with mercurial ointment, are generally effectual in palliating the itching and sometimes in entirely removing it. Trousseau describes, as "extremely efficacious," a solution of two drachms and a half of bichloride of mercury in three ounces of water, of which a dessertspoonful is mixed with a pint of *very warm* water, and employed as a vaginal injection and a lotion for the external organs. Wilson recommends the diluted nitrate of mercury ointment, the yellow, and the black wash.

Mercurial fumigation was once greatly in vogue as a means of treating syphilitic eruptions of the skin, and, indeed, other cutaneous diseases also. The red sulphuret (cinnabar) and the black oxide of mercury are the preparations which have been most employed in this way. The use of the vapors of cinnabar was, next

[1] Am. Journ. of Med. Sci., Jan. 1843, p. 86.
[2] Abeille Méd., Oct. 1845, p. 253.
[3] Bull. de Thérap., xxxvii. 76.
[4] Month. Journ. of Med., Jan. 1850, p. 60.
[5] Ibid., April. 1854, p. 300.
[6] Bull. de Thérap., xlviii. 289.
[7] Ibid., lxix. 100.

to that by mercurial ointment, the oldest of all the methods of treating syphilis. The patient was seated naked in a wooden box or closet with an aperture in the top, from which the head projected. Cinnabar having been strewn on burning coals, or on hot iron, its fumes were conveyed into the chest and surrounded the patient's body. An apparatus of a similar description has been contrived for fumigating a single limb. Even in this way mercurial fumigation has sometimes occasioned salivation, apoplexy, nervous accidents, chronic trembling of the limbs, etc. It has therefore been gradually abandoned, but its well-established efficacy and a more prudent method of applying it, promise to restore it again to its originally high rank among the applications of mercury to the cure of syphilis. Mr. Abernethy employed the fumes of the black oxide to induce the constitutional action of mercury with rapidity. Mr. Henry Lee preferred using the fumes of calomel. This method has already been described.

Dr. Nevins has used the vapors derived from mercurial cigarettes with advantage in *chronic thickening of the vocal cords, ozæna, nasal polypus, and catarrh of the Eustachian tube.*[1] The cigarettes may be made after the following directions, as originally suggested by Trousseau. Take nitrate of mercury, and strong nitric acid, of each fifteen grains, distilled water a sufficient quantity. Mix the acid and water, add the nitrate of mercury, and dissolve by a gentle heat. Saturate with the liquid a sheet of thick white blotting paper, six inches by eight in size, and dry it. Before it is entirely dry cut the paper into suitable strips for making tubes about one-eighth of an inch in diameter, and secure with gum. The interior of the tube may be stuffed with tobacco for those who are accustomed to smoking, but this addition it is better to dispense with. The paper when dry will burn steadily, and its smoke, on being drawn into the mouth, should be directed upon the seat of the disease.

Miscellaneous.—Dr. A. C. Castle has published the following ingenious method of *removing a gold ring* from a finger upon which it had been forced, and whence it could not be withdrawn on account of the swelling of the integuments. After drying the abraded skin with powdered chalk, he polished the ring, and applied quicksilver to its surface. In less than three minutes, by pressing the ring, it was broken to pieces and removed. Dr. C., it is stated, used a similar method of extracting a brass ring from the meatus externus of a child's ear.[2] Dr. Chapin, who was equally successful in removing two gold rings from a finger affected with paronychia, suggests that the ring should first be cleansed of unctuous matter with alcohol or ether.[3]

A solution of corrosive sublimate sufficiently strong to excite an eczematous eruption of the skin has been used for the removal of

[1] Liverpool Med.-Chir. Journ., iii. 117.

[2] Boston Med. and Surg. Journ., and Month. Journ. of Med. Sci., Dec. 1853, p. 546.

[3] Ibid., Feb. 1860, p. 82.

freckles and also of *powder grains* immediately after the explosion which drove them into the skin. Busch, of Bonn, who made use of the latter expedient successfully, employed compresses wet with a solution containing five grains of corrosive sublimate to an ounce of water, at first for an hour only at a time, and afterwards for several hours daily, until an eczematous eruption was developed. By its means the particles of powder were thrown to the surface and with a little care removed.[1]

Calomel has been found extremely efficacious in destroying or driving away the *maggots* which infest wounds in hot weather.

ARSENICUM.—Arsenic.

Description.—The term *arsenic* is strictly applicable to metallic arsenic alone, although it is commonly used to designate its preparations, and especially arsenious acid. Arsenic is one of the metals. It was obtained pure by Brandt in 1773. It is sometimes found native, but generally in combination with oxygen or sulphur, and associated with many minerals, especially tin, iron, copper, cobalt, and nickel. In its pure metallic state arsenic is a crystalline metal, of sp. gr. 5.8, of a steel-gray color, granular, brittle, and presenting a brilliant surface when recently broken. It tarnishes rapidly when exposed to the air, and forms a mixture of arsenious acid and metallic arsenic, which is used to destroy flies and other insects, and hence is sometimes called *fly-powder*. When rubbed between the fingers it imparts to them a peculiar odor, and its vapors, when it is sublimed at a temperature of 356° F., consist of arsenious acid, and diffuse a characteristic smell which closely resembles that of garlic.

Acidum Arseniosum.—*Arsenious Acid.*

This preparation, which is generally known as white arsenic, or simply as arsenic, is found native, but is generally produced by condensing the vapors which arise from roasting the ores of cobalt, and afterwards refining the product. In commerce it is found in masses and in powder. The former are white and opaque upon the surface, but transparent internally, and exhibit a vitreous fracture. The latter is white, and its particles are very fine. Arsenious acid is completely soluble in boiling water. It has neither taste nor smell, but it leaves a somewhat acrid sensation on the fauces, and when fused, and therefore deoxidized, it emits the odor of garlic which is characteristic of the heated metal.

Arsenici Iodidum.—*Iodide of Arsenic.*

This compound is prepared by heating a mixture of powdered arsenic and iodine in the proportion of one of the former to five of the latter, by weight. It is "an orange red crystalline solid, entirely soluble in water, and wholly volatilized by heat."

[1] Virchow's Archiv, xiv. 379.

LIQUOR ARSENICI CHLORIDI.—*Solution of Chloride of Arsenic.*

It is made by boiling arsenious acid in muriatic acid and distilled water. It has the same strength and properties as Fowler's solution. Dose, five minims, largely diluted, after meals.

LIQUOR SODII ARSENIATIS.—*Solution of Arseniate of Sodium.*

This preparation is a solution of sixty-four grains of arseniate of sodium in a pint of distilled water. Dose, five drops, which may be gradually increased.

LIQUOR ARSENICI ET HYDRARGYRI IODIDI.—*Solution of the Iodide of Arsenic and Mercury; Donovan's Solution.*

Vid. HYDRARGYRUM.

LIQUOR POTASSII ARSENITIS.—*Solution of Arsenite of Potassium; Fowler's Solution; Tasteless Ague Drop.*

This is a solution of equal parts of arsenious acid and bicarbonate of potassa in boiling distilled water with the addition of a small quantity of compound spirit of lavender, in order to give it sufficient color and taste to prevent its being mistaken for simple water. It contains four grains of arsenious acid to the fluidounce.

This preparation is a transparent liquid, and has no taste or smell but what it derives from the spirit of lavender. It is incompatible with the metallic salts, with infusions and decoctions of cinchona, and with lime-water.

Dose, five drops, gradually increased to ten or twenty, three times a day, largely diluted, and taken after meals.

SODII ARSENIAS.—*Arseniate of Sodium.*

This compound is made by heating together arsenious acid, nitrate of sodium, and dried carbonate of sodium, and dissolving the product in boiling hot water. From this solution the salt is deposited in colorless transparent crystals, which have a saline and somewhat acrid taste.

History.—The ancients were acquainted with auripigmentum, or orpiment, the yellow sulphuret, and with sandarach, or realgar, the red sulphuret, of arsenic. Of the former, Dioscorides says: It is astringent and corrosive, burning the skin with severe pain, and the production of an eschar. It removes fungous flesh, and is a depilatory. He describes the qualities of the latter in nearly the same terms; stating that, mixed with resin, it causes hair to grow when destroyed by pellagra, and that with pitch it serves to remove rough and deformed nails. With oil it is used to destroy lice, to resolve abscesses, to heal ulcers of the nose (lupus?), of the mouth and fundament. With wine it is given for fetid expectoration, and its vapors, with those of resin, are inhaled in chronic cough. With honey it clears the voice, and with resin is very excellent for shortness of breath.[1] Pliny furnishes exactly the same description.[2]

[1] Mat. Med , lib. v. cap. lxxx. and lxxxi.
[2] Hist. Nat , lib. xxxiv. cap. lv. lvi.

Paulus Ægineta says, sandarach and arsenic, when taken in a draught, occasion pains of the stomach and bowels, with violent corrosion.[1] The Arabians give to arsenic a name equivalent to the modern one of ratsbane.[2] Rhazes, Avicenna, and other Arabian writers, have done little more than copy the description of Dioscorides. Both orpiment and realgar have long been known in China. The former is employed externally for venomous wounds, and as a sternutatory to counteract miasmatic effluvia, and also internally as a tonic in several diseases. Realgar is used by the Chinese in intermittent fever.[3]

The production of arsenious acid is ascribed to Geber, who flourished in the eighth century, and enriched chemistry with the discovery of corrosive sublimate, of nitrate of silver, and of other valuable compounds. Geber denominates arsenious acid sublimed arsenic, indicating the mode in which it was then and is still procured. Avicenna terms it white arsenic, and says that it is a deadly poison; "interficit homines." In spite of its dangerous qualities, proved by many examples of fatal poisoning, arsenic gradually found its way into the hands of the surgeons. At first it was used for the cure of the external diseases of sheep and horses, and afterwards, in the fourteenth century, in the treatment of scrofulous ulcers in man. At the close of the seventeenth and the beginning of the eighteenth century, it was employed as a caustic for cancerous tumors by men of some distinction, but the more eminent surgeons condemned its use.[4] Meanwhile the native physicians of India had long been in the habit of resorting to it as an internal remedy for various affections of the skin, including those connected with secondary syphilis, and also for intermittent fever. In modern Europe, however, it appears not to have been prescribed internally until the beginning of the seventeenth century, when, as in ancient times, orpiment was employed for the relief of pulmonary affections attended with dyspnœa, and arsenious acid was used to cure intermittent fever. At the close of the seventeenth, and at the beginning of the eighteenth century, its febrifuge qualities were in constant requisition, at least by irregular practitioners in Italy, France, Pannonia, and Thuringia. But the remedy did not then, nor for a long time afterwards, gain acceptance with the faculty.[5] Thus we find Lemery declaring that it ought never to be taken internally in any dose, or in any manner, whatever;[6] and Geoffroy, after stating that it is recommended by some in intermittent fevers, says: "Let it be never so much prepared and corrected, its deleterious qualities are only lessened, but never wholly removed: and, therefore, though it may be a good remedy for the present, it will afterwards prove a poison, and bring on very dismal symptoms. Arsenic, therefore, in my opinion, is worse than the fever itself."[7]

[1] ADAMS's Trans., Syd. Soc. ed., ii. 235; iii. 58.
[2] EBN BAITHAR, ed. Sontheimer, ii. 104.
[3] Edinb. Month. Journ., iii. 172.
[4] GMELIN, Apparat. Med., i. 259.
[5] HARLESS, de Arsenici Usu., p. 61.
[6] Dict. des Drogues, 2ème ed., 1714, p. 82.
[7] A Treatise of the substances made use of in Physick, etc. Translated by G. DOUGLAS, M.D., 1736.

Meanwhile, however, arsenic was making its way to a better reputation through the writings of Slevogt, Frick, Keil, Jacobi, and Ackerman, and about the close of the century was accepted as a legitimate medicine by some of the most eminent physicians, among whom may be named Plencitz, in Germany, Brera, in Italy, and Fowler, in England. Fowler was led to employ this remedy without, probably, knowing that it had been used upon the continent. He learned that a nostrum which, under the name of Patent Ague Drops, became famous for its cures of intermittent fever, about the year 1670, was an arsenical solution.[1] It had, however, been still earlier employed in England. In 1774, Mr. Mowbray, a surgeon, purchased from the widow of a German empiric, a receipt for the preparation of a remedy which he had employed as a specific in the cure of agues. Its principal ingredient was arsenic. This receipt Mr. Mowbray communicated to several of his medical friends, and employed, himself, with great success.[2] Besides Fowler, must be mentioned among those who gave currency to the use of the medicine, Withering, Pearson, Girdlestone, and Adair, in England; Horn, and Harless, in Germany; and Barton, Rush, and Currie, in the United States. These, and many other physicians, established its value in intermittent fever, neuralgia, and scaly affections of the skin, the diseases in which its virtues are most conspicuous. Notwithstanding its well-established virtues, arsenic fell into disuse, and was for a long time quite neglected, when Cazenave, Biett, and Trousseau and Pidoux in France endeavored to revive its application especially to cutaneous diseases; but in this, as in so many other instances, blind faith in a theory prevailed over clinical demonstration, and the contemptible inanities of Broussaisism, which, like other systems, only called for faith, commended themselves to the medical profession rather than doctrines and precepts which tasked the intellect to appreciate and the judgment to apply. The publication by Boudin, in 1842, of a work which demonstrated the efficacy of arsenic in periodical fevers, and vigorously advocated its use, gave the first impulse to those numerous researches into the action and uses of the mineral which have since appeared.

Action. *On Plants.*—An arsenic solution causes plants to fade, wither, and decay. The vegetation in the neighborhood of furnaces used for smelting arsenical ores, always presents a wan and withered look. Arsenic is also said to prevent the development of buds, and the germination of seeds. In regard to the latter point, Headland remarks: "The grain of wheat will germinate, and its starch be converted into sugar, after it has been steeped in a solution of arsenic to protect it from vermin."[3] In this case the coriaceous nature of the envelope protects the germ from the contact of the solution. When plants have been killed by being watered with an arsenical solution, they exhale an alliaceous odor. M. Chatin thus

[1] FOWLER's Med. Reports. Preface.
[2] W. CURRIE's View of the Diseases, etc., p. 29.
[3] On the Action of Medicines, p. 198.

describes the manner in which plants perish under this operation. They may die in the course of a few days, by desiccation, if they are in a dry place, or by putrefaction if they are in a moist one. Sometimes the plant resists the poisonous influence with partial success. Its growth ceases, its leaves become yellow and dry, and sometimes spots, gangrenous as it were, appear upon the stalk, etc. These changes are more rapid in summer than in winter. Nor does the poisonous action appear to be equally diffused through the plant. It is accumulated in the leaves and in the receptacles of the flowers, but still abounds in the fruit, seeds, and stems. If the plant does not immediately perish, it gradually recovers, as the poison is eliminated; and this is accomplished in a period varying from a fortnight to three months. The arsenic enters into combination with the alkalies of the plant, forming soluble salts which are excreted by the roots, and for some time may be found in the soil.[1]

On Animals.—Jæger found that animalculæ inhabiting vegetable infusions, perish in from ten to thirty minutes on the addition of a minute quantity of arsenious acid to the liquid. Arsenic is equally fatal to spiders, flies, worms, leeches, and *crustaceæ*, such as crawfish, etc.; and before killing these creatures it excites in them convulsive movements and a discharge of the excretions. Even the salmon and the gudgeon perish with similar symptoms, but more slowly. Birds are still more tardily and incompletely affected, some of them surviving a dose of the poison sufficient to destroy an amphibious animal of equal size. When arsenic is introduced into the bowels, into the peritoneal cavity, or the cellular tissue, of birds, the following phenomena are observed; at first general repose, then winking of the eyelids, liquid and sometimes bloody stools, spasms of the pharynx, vomiting and general trembling; thirst, erection of the feathers, and corrugation of the integuments. If the poison does not prove fatal, it induces languor, and loss of appetite, with copious, loose, and greenish stools. When fatal, on the other hand, great debility, insensibility to external impressions, opisthotonos, and paralysis, precede death, after which, according to several authorities, the muscles are found, in a great measure, insusceptible to the galvanic influence.[2] Brodie, on the other hand, states that "the muscles are capable of being excited after death to distinct and powerful contractions by means of the Voltaic battery."[3] But he also found that when the heart continued to act after apparent death, he was never, in a single instance, able to prolong its movements by means of artificial respiration.

The symptoms of arsenical poisoning in quadrupeds are very uniformly the same, whether the poison act through the bowels, or is absorbed from a wound; but in the latter case its effects are more rapidly manifested. The animal seems to experience pain, often of the greatest severity, the breathing is hurried, the pulse feeble,

[1] Toxicologie, i. 380.
[2] Edinb. Med. and Surg. Journ., Jan. 1811; ORFILA, op. cit.
[3] Physiol. Researches, p. 82.

slow, and irregular; severe retching is followed by vomiting, and mucous and sometimes bloody stools, the hinder legs become paralyzed, and then the other parts of the body, insensibility to all impressions ensues, and occasionally convulsions precede death.

In his numerous experiments on animals poisoned by arsenic, and prevented from vomiting by ligature of the œsophagus, Orfila found that almost immediately after their death, traces of the poison were readily detected in the blood, liver, spleen, kidneys, lungs, heart, brain, and muscles, but chiefly in the liver and spleen. It was his opinion, however, that a portion of the poison reached these organs by imbibition through the coats of the stomach. According to Brodie,[1] in animals killed by arsenic, the blood is usually found to be fluid in the heart and vessels; but otherwise the morbid appearances are confined to the stomach and intestines, and to the former especially, by whatever channel the poison may have been introduced. Indeed, the gastro-intestinal inflammation is greater in degree and more speedy in taking place when arsenic is applied to a wound, than when it is taken into the stomach. The inflamed parts, says this experimenter, are, in general, universally red, at other times they are red only in spots. The principal vessels leading to the stomach and intestines are much dilated, and turgid with blood; but the inflammation is usually confined to the mucous membrane of these viscera, which assumes a florid red color, becomes soft and pulpy, and is separable without much difficulty from the cellular coat, which presents its natural appearance. In some instances, there are small spots of extravasated blood on the inner surface of the mucous membrane, or immediately beneath it, and this occurs independently of vomiting. In none of his experiments did Brodie find ulceration or sloughing of the stomach and intestines, and he is disposed to believe that such lesions are never the cause of death, unless life is prolonged considerably beyond the period of the first and most characteristic operation of the poison. Lolliot[2] called attention to the error of nearly all writers upon the subject in asserting that arsenic uniformly gives rise to an inflammation of the gastro-intestinal mucous membrane, whether its toxical effects are occasioned by small or by large doses, and stated that when animals take small doses of arsenic continuously, that is, doses varying from a few milligrammes up to four grains, the digestive tube presented no signs of inflammation, except in one case in which the lining membrane of the intestine was injected and the colon filled with a fibrinous exudation in concentric laminæ. Most frequently the large intestine was the seat of bloody extravasations. Prof. Boehm, of Dorpat,[3] recently arrived at conclusions which are so nearly identical with those of Brodie and of Lolliot, with which he seems to have been unacquainted, as to afford strong confirmation to both. He particularly dwells upon the identity of effects, whether the arsenical preparation be introduced

[1] Op. cit., p. 87.
[2] Etude Physiologique de l'Arsenic, Paris, 1868.
[3] Archiv f. Exper. Pathol. etc., ii. 89 (1874).

into the stomach or the veins, and on the absence of any ulceration or other lesion demonstrating a local and corrosive action. He, however, describes what the earlier experimenter had not noticed, a thick, yellowish, and tenacious exudation, formed entirely of white corpuscles and constituting a false membrane, under which the mucous membrane is found dotted with ecchymoses, and for the most part destitute of epithelium. Such ecchymoses he also found uniformly under the endocardium of the left ventricle, and frequently under the other serous membranes. He did *not* meet with fatty degeneration of the liver or the kidneys. A very important conclusion was that the intestinal lesions just described did not result from an elimination of arsenic by the intestinal mucous membranes, for a careful chemical investigation disclosed only a trace of arsenic in the contents of the bowel. The vascularity of the gastro-intestinal mucous membrane and its hypersecretion he is therefore disposed to attribute to the action of the poison upon the bloodvessels themselves.

On Man.—According to Mialhe, it is probable that metallic arsenic, and also its sulphurets (realgar and orpiment), are not in themselves poisonous. But the arsenical sulphurets of commerce contain a large proportion of arsenious acid. When either of these preparations, or metallic arsenic itself, is taken into the stomach, it may furnish to the alkaline chlorides contained in the gastric secretions, the material for forming arsenious acid in sufficient quantity to operate as a poison.[1]

External Application.—When arsenious acid and other active preparations of arsenic are applied to the denuded skin, or to a mucous membrane, or are introduced into a wound, symptoms of arsenical poisoning ensue. Examples of this event are innumerable, but a few may briefly be cited as illustrations in this place. One of the very earliest is that recorded by Amatus Lusitanus, of a boy who (in 1567) died from the application of an arsenial ointment to the scalp for the cure of scabies. In another case, of pityriasis, a similar application was fatal.

Orfila mentions a woman who barely escaped with life after using an arsenical ointment for the purpose of destroying lice that infested her head. Dr. McCready, of New York, reports that a child two years of age died in consequence of having its head washed with a mixture of arsenic and gin, for the cure of favus. No local inflammation followed; but diarrhœa, tenesmus, and paraplegia preceded death. Two other children who were treated in the same manner recovered.[2] A fatal case of similar origin is reported by Dr. Taylor.[3] Inflammation of the gastro-intestinal mucous membrane was found after death. In 1853 Dr. Mitchell, of Liverpool, reported the following case. A man applied a mixture of arsenic and soft soap, procured for killing bugs, to the pubes, scrotum, and axillæ, which were infested with pediculi. Within twelve hours

[1] Chimie Appliquée, p. 248. [2] Am. Journ. of Med. Sci., July, 1851, p. 259.
[3] Guy's Hosp. Rep. 3d ser., x. 220.

the cuticle of the scrotum peeled off, leaving the cutis raw and bleeding, and the testes swollen. There were stiffness of the neck, and slight difficulty of swallowing, with thirst, headache, and extreme sensitiveness and tension of the hairy scalp. The stomach was irritable, and there was also vomiting, with pain at the epigastrium on pressure. Recovery took place slowly under the influence of opiates and demulcents.[1]

A man engaged in washing sheep with an arsenical solution, had his abdomen wet with it for about two hours. Shortly afterwards, the integuments of this part, and of the scrotum, penis, and thighs became red and painful, and afterwards ulcerated in some places. He showed signs of considerable constitutional derangement.[2] Cases of the same sort are referred to by Crawford,[3] and Watson.[4] The last-named reporter alludes to intense thirst as a symptom of the affection thus produced. A case of arsenical poisoning by the use of green sewing silk is reported by Dr. Harlow.[5] Polli applied a poultice covered with muslin to an eruption of tartar emetic pustules on a boy's chest. The patient afterwards suffered from great prostration, pain in the head or neck, dryness of the fauces and mouth, a constant desire to urinate, and slight delirium. On examining the interposed muslin, which was green, it was found to be dyed with an arsenical pigment. It was removed, and the symptoms subsided.[6]

Sometimes the medicine has been employed with criminal intent. Mangor relates the case of a peasant who poisoned three women in succession, by introducing arsenical paste into the vagina. In one it caused severe pain and inflammation of this organ, with constant vomiting, and delirium. The external parts of generation were greatly swelled, and after death the os uteri was dilated, and its edges gangrenous. Ansiaux speaks of a man who poisoned his wife in the same manner:[7] and a more recent example in Germany is reported by Brisken.[8]

Many instances are recorded of absorption of the poison from an ulcerated surface. Orfila mentions a case which terminated fatally, of a person who had an ulcer of the leg treated by a quack with arsenious acid.[9] Roux states that a man who had a cancer dressed with arsenical paste, died after experiencing vomiting and convulsions, and on dissection, his stomach was found inflamed, and studded with black points.[10] Long ago (1586), Baccius saw the same effects from such an application to an ulcer of the groin. Fabricius Hildanus refers to a case in which its use upon an ulcer of the hand was followed by pain, distress, fever, nausea, vomiting, delirium, and death; and the same writer refers to two other in-

[1] Times and Gaz., Dec. 1853, p. 612.
[2] Brown, Edinb. Med. Journ., iii. 149.
[3] Lancet, Aug. 1857, p. 127.
[4] Ibid., Sept. 1857, p. 281.
[5] Boston Med. and Surg. Journ., Feb. 1867, p. 64.
[6] Brit. and For. Med.-Chir. Rev., April, 1864, p. 532.
[7] Wibmer, Wirkung, etc. vol. i.
[8] Casper's Viert. (1864), xxv. 110.
[9] Toxicologie, 5th ed., i. 413.
[10] Méd. Opératoire, i. 64.

stances presenting analogous characters. Meau saw death ensue from the like application to an ulcer of the foot.[1] A case is related by Dr. Hoit in which an "Indian doctor," having applied a plaster supposed to be arsenical to an enlarged lymphatic or parotid gland, after incising the swelling, the patient was seized with violent abdominal pain, vomiting of a black and offensive liquid, stools of the same character, and great prostration. At the end of a month the patient was abandoned by the quack, and died with the usual symptoms of arsenical cachexia.[2] In York, England, one James Lawrence Ward was tried, in 1854, for manslaughter, he having treated a woman for cancer of the breast by means of an arsenical paste. The disease was not arrested, and the woman died.[3] In 1869 at Paisley, Scotland, a nursing woman had a "weed" or indurated breast, which a quack assured her was cancer, and after blistering, applied to it a caustic arsenical paste. Severe burning pain in the part, with violent headache, thirst, sickness, and occasional retching; numbness in the arms and legs, sleeplessness and loss of appetite supervened. After several days the patient was seized with convulsions, in one of which she died. After death, arsenic was found in the liver, kidneys, and coats of the small intestines, but not in the stomach, spleen, or blood. The ointment contained about half its weight of arsenic.[4]

Arsenical Vapors.—It is related that persons have been poisoned by the fumes of tapers, the wicks of which had been saturated with arsenic with a criminal intent. The same effect has resulted in our own times from the vapors of candles into which arsenic had been introduced to harden them. It is also said that smoking tobacco mixed with arsenic has proved fatal. A case is reported in which the fumes of five grains of this substance, thrown upon live coals, produced very distressing symptoms in a person sleeping in the room where this hazardous experiment was performed.[5] A case is quoted by Beck, from Vandervoot, of some men, nine in number, who were employed in sweeping up arsenic scattered in the hold of a vessel, from a barrel of this substance which had been broken in the hoisting. Several were seized with vertigo, and fell senseless; they were then attacked with vomiting and the other symptoms of arsenical poisoning. Of the nine cases two or three proved fatal in the course of a few days.[6] Numerous instances are recorded of alarming effects from arsenical fumes. They generally include the following: debility, dyspnœa, præcordial pain, and constriction, with severe cough; headache, pains in the limbs, muscular spasms, and paralysis; thirst, nausea, vomiting, dryness of the mouth and fauces, and colic; and where the influence is prolonged, ulcers form upon the buccal mucous membrane. The pulse is generally frequent, and in some cases yellow spots appear upon the skin. Dr.

[1] WIBMER, op. cit.
[2] New York Med. and Phys. Journ. (1824), iii. 375.
[3] Brit. and For. Med.-Chir. Rev. July, 1855, p. 280.
[4] Glasgow Med. Journ., 1869, p. 56. [5] RICHTER, Ausfür. Arzneim. v. 679.
[6] Med Jurisp., from N. Y. Journ. of Med. and Surg., ii. 483.

Hinds, of Birmingham, relates that having had the walls of his study newly hung with a bright-green paper, which was afterwards found to be stained with Scheele's green (arsenite of copper), and after occupying the apartment by gas-light, he was affected with great depression, faintness, nausea, an inclination to vomit, and severe pains in the abdomen.[1] Mr Taylor, of Liverpool, suggests a very probable explanation of the peculiarly deleterious qualities of paper hangings colored with arsenical compounds, viz.: that the body of the paper and the paste which attaches it to the wall are composed of materials very susceptible of putrescent fermentation, and that when this process takes place the arsenic becomes volatile in the form of arseniuretted hydrogen.[2] The following is given as a catalogue of the symptoms occasioned by this form of arsenical poisoning. First appears irritation of the mucous membrane, causing diarrhœa and vomiting with permanent indigestion; severe coryza, ulcerated throat, bronchitis, spasmodic cough and asthma, a scalded condition of the lips, tongue, and cheeks, conjunctivitis, and inflammation of the eyelids; severe bilious and feverish attacks. In many cases there is palpitation of the heart. There are pains in the spine and limbs, and the joints are swollen and stiff; the skin grows rough and scaly, and the disorder of the nervous system is shown by great irritability, depression, and prostration. The list also includes giddiness, headache, acute earache and neuralgia; bleeding at the nose, frightful screams, hysterical attacks, loss of memory, cramps, numbness, spasms, and convulsions. The writer who furnishes this summary states that many wall papers, besides the green, contain arsenic, especially some blue colors produced by "arsenical cobalt;" "mauve," and even red paper hangings may contain the poison.[3] Poisonous effects have been observed in girls and others engaged in the manufacture of artificial leaves and flowers colored with arsenic. Miners, and other workers in arsenic, suffer more or less in their health from the poisonous exhalations. The diseases engendered are essentially chronic, but sometimes fatal.

[1] Times and Gaz., Feb. 1857, p. 177. Numerous other cases of illness from the same cause have been published, all tending to show the extremely deleterious nature of the pigment referred to. The following articles upon this subject may be consulted: HINDS, Times and Gaz., May, 1857, p. 521; ibid., Jan. 1858, p. 64; HALLEY, ibid., p. 76; GRISWOLD, New York Journ. of Med., July, 1858, p. 64; WHITEHEAD, Brit. and For. Med.-Chir. Rev., April, 1859, p. 519; HASSALL, Lancet, Jan. 1859, p. 70; TAYLOR, Times and Gazette, Jan. 1859, pp. 5 and 94; KESTEVEN, ibid., p. 43; and WRIGHT, ibid., p. 169; Lancet, Nov. 1860, p. 494, and Dec. 1860, p. 535; Boston Journ., Nov. 1860, p. 299; Annales d'Hygiène, 2d ser., xv. 201; Henke's Zeitschrift, lxxxi. 78; Deutsche Klinik, July, 1861, pp. 261; 299; London Lancet and Times and Gaz, 1862. Since the second edition of this work was published numerous additional cases of the same nature have appeared in the medical journals. VOHL has shown (CASPER's Vierteljahrs., xv. 172) that each square yard of such paper as is referred to in these cases contains, on an average, one grain of arsenious acid, five-sixths of a grain of oxide of copper, and one grain and a quarter of oxide of lead. The third Annual Report of the State Board of Health of Massachusetts, 1872, contains a compilation of the existing information on the subject of poisoning by arsenical pigments which may be consulted with advantage. It includes specimens of arsenical paper hangings.

[2] Lancet, July, 1864, p. 124.

[3] British Med. Journ., July, 1871, p. 101; ibid., Sept. 1871, p. 392.

The general symptoms are said to consist of dyspepsia, headache, difficult and painful urination, dyspnœa, palpitation, convulsions, paralysis, sometimes dropsy. The local effects are coryza, nasal ulcers, hoarseness, sorethroat, red and swollen gums with salivation, and a whitish line along the edge of the gums produced by the lodgment of arsenical dust. The skin where most delicate is apt to be attacked with erythema, and an itching papular eruption. There is a constant and slow fever, with loss of flesh, colic, and paralysis.[1] Schweinfurth's green, which is a solution containing equal quantities of arsenious acid and acetate of copper, used in the manufacture of paper-hangings, produces in the workmen who handle it vesicles, pustules, and ulcers upon the hands, and on parts of the body habitually touched by the soiled fingers.[2] The manufacturers of paper-hangings, and of artificial flowers, the women who make dresses dyed green with arsenical preparations, and even those who wear such dresses, suffer from arsenical poisoning. It is said that a dress pattern of twenty yards was found to contain three hundred grammes of coloring matter, of which no less than twenty consisted of an arsenical compound. (*Lolliot.*)

Internally.—In small or medicinal doses ($\frac{1}{30}$ to $\frac{1}{15}$ of a grain), arsenic excites a sense of warmth in the stomach and bowels, increases the appetite, and in some degree also the fæcal and urinary discharges. According to Vogt, this stimulant effect is shared by all parts of the system. The skin is warmer, the pulse fuller and more frequent, the muscular system more active, and the whole organism invigorated, freer, and lighter in its movements, and even the mind improves in activity and power. In doses such as occasion no sensible phenomena, or only after the lapse of many days, arsenic seldom produces chronic poisoning; on the contrary, digestion appears to be permanently fortified, "as when true tonic medicines, and especially cinchona, are administered." Among recent authorities Waher attributes to arsenic nearly all of the virtues ascribed to it by Vogt. It is well known, says this author,[3] that old and worn-out horses recover their appetite, activity, and strength under the operation of small doses of arsenic, and later authorities inform us that in Vienna the grooms are accustomed to mix a small quantity of arsenic with the feed given to horses, and to attach a portion to the animal's bit, for the purpose of producing a bright aspect of the skin, roundness and elegance of the form, and foam at the mouth. The medicine is also said to put them in a singularly good condition to perform long journeys, particularly in a hilly country; but it is also added that when the use of it is left off, the horse gets thin, loses his freshness, and becomes dull.[4] Vogt further reports that,

[1] PATISSIER, Maladies des Artisans, p. 20.

[2] FOLLIN, Archives Gén., 5ème sér., x. 683; PIETRA SANTA, Annales d'Hygiène, 2ème sér., x. 339; GUY, Archives of Med., i. 86; Prager Viert., lxvii., Anal., p. 112; N. A. Med. and Surg. Rev., iv. 1111; Brit. and For. Med.-Chir. Rev., Oct. 1863, p. 536.

[3] Lehrbuch der Pharmakodynamik, 3tte Aufl.; i. 591.

[4] Times and Gazette, July, 1854, p. 67.

according to Jæger, a pigeon, to which arsenic was given, displayed greater vivacity and a stronger appetite than before. In upper Steyermark it is said that the peasantry employ arsenic as a stomachic, and as a condiment with several kinds of food, particularly with cheese; and it is related of a healthy peasant that every day he was accustomed to take two grains of arsenic, and did not believe that he could live without it.[1] This curious statement, when originally made, did not attract much attention, but more recently additional testimony has appeared to lend it support, and excite inquiry as to its correctness. In 1854 Dr. Tschudi published the following statement in a Vienna medical journal: "In some countries of Lower Austria and Styria there exists among the peasantry the singular habit of eating arsenic. These poison-eaters have a double aim; first, they wish to give themselves, by this dangerous habit, a fresh and healthy appearance, and a certain degree of *embonpoint*. Many of the peasant girls, and even the men, have recourse to this expedient from coquetry and a desire to please; and it is remarkable what success they attain, for the young toxiphagi are distinguished by the freshness of their complexion, and by a look of ruddy health. . . . . The number of deaths from the abuse of arsenic eating is by no means inconsiderable, especially among the young people; . . . . but so careful are the victims to conceal what they have done, that the secret often is revealed only on the death-bed. The second advantage gained by the toxiphagi is that they become more active, more free in respiration, and able to ascend high mountains with ease. Upon every long excursion into the mountains they take a small piece of arsenic, which they allow to dissolve in the mouth. The effect is surprising. They ascend without difficulty heights which would have been almost insurmountable without this practice. The author adds that, upon this experience, he has advantageously administered Fowler's solution in cases of asthma. The toxiphagi commence with a bit of arsenic the size of a lentil-seed, or about half a grain. They keep to this dose, which they swallow several times a week, morning and evening, for a long period, to become accustomed to it. Then they increase the quantity insensibly, but with precaution, until the desired effect is produced. . . . . It is to be remarked, however, that, when the practice is dropped, emaciation generally ensues either from the withdrawal of the stimulus, or from accidental or acquired disease."[2]

The accounts given by Vogt and Tschudi, and substantially confirmed by Kaltenbrenner, Vitzhum, and other writers, were ridiculed or contradicted by Pereira, Christison, Taylor, Kesteven, and Inman. They asserted that the descriptions of the practice of arsenic eating were derived from hearsay evidence alone; questioned whether the substance used was really arsenic; declared that its alleged effects are at variance with common experience in regard to arsenical pre-

[1] VOGT, loc. cit., and Med. Jahrb. des öster. Staats, 1822, i. 99.
[2] Times and Gazette, July, 1854, p. 66.

parations, and opposed to those known to be produced by arsenical emanations upon the miners in Cornwall, etc. These criticisms being all based on conditions presumed, but not proved, to be analogous to those which exist when arsenic is taken under ordinary circumstances as a medicine, should have but little weight in opposition to direct and circumstantial testimony.[1] It is to be remarked that the ancients employed arsenical preparations for "shortness of breath." The researches of Dr. Maclagan in Styria leave no doubt whatever of the substantial correctness of the original accounts which were published respecting the arsenic eaters. This physician had interviews with several of them, and learned that they generally made use of yellow arsenic, or orpiment, taking about a grain twice a week. They stated that on omitting it for any longer period, a longing for it was experienced which was relieved by a repetition of the usual dose. To one of these persons he administered about five grains of arsenious acid, and to another about six grains, and the urine of both afterwards gave abundant evidence of the presence of the drug; but neither of them suffered the slightest inconvenience.[2] More recently Werber has stated that arsenic eaters, properly so called, live in certain localities in Steyermark, Tyrol, and Salzburg. They consist: 1. Of men whose occupation obliges them to climb high mountain peaks; 2. Of young persons of chlorotic tendencies who by means of arsenic endeavor to render the complexion more blooming and the figure fuller; and 3. Rarely by asthmatic patients as a medicine. He confirms the statements above given of its mode of administration and effects.[3] Von Vest, who also investigated the subject, says: "The arsenic eaters belong mostly to the lower classes. They fall into the habit at the early age of fifteen, and continue it until the ages of seventy and seventy-six. Although females are not averse to it, the majority of arsenic eaters are males. They are generally strong, healthy persons, courageous, pugnacious, and of strong sexual dispositions."[4] A case, which fully confirms the statements now made, is reported by Prof. La Rue, of Quebec.[5] An Englishman, 47 years of age, long resident in Canada, supposing himself liable to consumption, and having heard that arsenic was a remedy for that disease, procured two ounces of white arsenic, which, in doses of from two to five grains, he consumed in six or eight weeks, partly by swallowing it, and partly by smoking it with tobacco. He never experienced any of the constitutional effects of the medicine, nor did it ever affect him with nausea or vomiting. His general health was good, and he never suffered from pains in the stomach or bowels, which were regular in their action. In the presence of Dr. La Rue he swallowed, on one occasion, three grains, and on another four grains, of arsenious acid, with the first dose smoking half a grain and with the second one grain. No unusual

[1] See Brit. and For. Med.-Chir. Rev., Jan. 1852, p. 142, where the question is examined, and the alleged tonic and eupeptic operation of arsenic eating is discredited.
[2] Edinb. Med. Journ., x. 200. [3] Prager Vierteljahrs., cix. Anal., 98.
[4] Edinb. Med. Journ., xvi. 569. [5] Bost. Med. and Surg. Journ., 1866, p. 439.

symptoms were manifested, the patient affirming "that the dose had produced no more effect upon him than if he had taken a glass of cold water." The effects of the drug are not, however, always so innocent. A case is reported, from what source is not stated, which occurred in 1862. A man was induced, by the accounts he had read of arsenic eaters, for several years to take as a daily dose of arsenious acid, as much as could be held on the point of a pen-knife, when, in the hope of dissipating certain dyspeptic symptoms, he took an increased dose for a period of six weeks. The usual gastric symptoms of irritant poisoning then made their appearance; the face had a greenish tint; there was neither headache nor mental disorder; but gradually the secretion of the urine ceased, and the patient died.[1] There is, apart from the statement given above, some reason to believe that toleration of arsenic may be partially, at least, produced. Flandin states that he gave animals doses of arsenious acid in powder, commencing with one sixty-fifth of a grain mixed with their food; and that in nine months, by progressive increase, they bore a dose of upwards of fifteen grains of arsenious acid in powder in twenty-four hours without their appetite or health becoming affected.[2] This, says Dr. Taylor, is contrary to all experience in the medical use of arsenic in the human subject;[3] but it tallies with the statements respecting the arsenic eaters of Austria.

The solution of arsenite of potassa, in doses of two or three drops, gradually increased to seven or eight drops,[4] three times a day, seldom produces any immediate effects. If the quantity given at first be ten or twelve drops, it is apt to occasion loss of appetite, nausea, and griping, and even vomiting and purging, with epigastric pain. These symptoms are most distinct immediately after each dose of the medicine, particularly when the stomach is empty. A metallic taste in the mouth is sometimes perceived, and may be taken as a sign that the system is saturated with the poison. The urine is occasionally increased, more rarely perspiration occurs, the conjunctiva becomes more or less injected, and in some few instances an eruption of urticaria, pityriasis, or psoriasis appears upon the skin. The pityriasis chiefly affects parts covered by the clothing; "it has a dirty brown, dingy, unwashed appearance." The continued use of arsenic has in some cases caused the hair to fall out, over the whole scalp, or in patches (*alopecia areata*).[5] In a case of acute arsenical poisoning, and a fortnight after the patient had apparently recovered from its effects, "the face, head, hands, and feet were swollen, and the whole surface of the body was of a bright red color." "After a few days the skin partially desquamated and was tender to the touch; and this was followed by an attack of psoriasis which extended over the whole body. The hair of the

[1] Bull. de Thérap., lxxi. 473.
[2] Taylor, On Poisons, p. 6.
[3] Ibid. (2d Am. ed.), p. 94.
[4] Six drops of Fowler's solution are equivalent to nearly twelve minims of the same, or to one-twentieth of a grain of arsenious acid.
[5] Archiv der Heilkunde, xi. 395.

head, the eyebrows and eyelashes fell off, as did also the nails." All remedies were for a long time tried in vain until Fowler's solution was administered, when improvement at once began, and a perfect cure rapidly followed.[1] Urticaria has sometimes followed a single dose of the medicine, and in rare cases giddiness and tremors have been observed.[2] Along with these symptoms, but independently of them, and under the influence of continued small doses of arsenic, a characteristic puffiness of the face arises, with œdema of the eyelids, which at first is most visible in the morning, but is afterwards more permanent and extensive, occupying the ankles, the limbs, and the abdomen with a dropsical effusion. As under larger doses the urine may become bloody, so it may become albuminous under the operation of those we are considering. Several cases of the sort have been reported by Dr. S. W. Mitchell.[3] When the dropsy is not excessive, it generally subsides on the suspension of the medicine. The albuminuria is probably explicable by the results of Saikowsky's experiments; for he found that when rabbits were slowly poisoned by arsenious acid, both the liver and the kidneys underwent fatty degeneration; the latter organs were enlarged and the urinary ducts distended with drops of fat.[4] This degeneration was observed by Lolliot in similar experiments undertaken by him; and the heart itself has been found affected with a like alteration.

In rather larger doses, arsenic acts as a gastric irritant, occasioning a sense of constriction of the œsophagus and stomach, with a pricking and somewhat burning sensation at the epigastrium; thirst is increased, but the appetite declines, eructations ensue with nausea, and vomiting is readily provoked. There is a tendency to diarrhœa, and the urine is voided frequently. To these phenomena are superadded flushes of heat, especially felt in the head and abdomen, with cool perspiration of the forehead and cheeks; the pulse is more frequent and is sometimes irregular; the patient feels exhausted, but uneasy and restless, and if of a nervous temperament, may be affected with spasmodic movements. In the course of twelve or twenty-four hours these symptoms disappear. In this degree of its operation arsenic first manifests poisonous qualities.

If the influence of the drug is sustained, permanent derangement of the system, or *chronic arsenical poisoning*, ensues; the loss of appetite, nausea, derangement of the digestion, diarrhœa, or constipation continue, with thirst, salivation, tenesmus, colic, and intestinal cramps; the respiration is labored and painful, a sense of oppression is experienced, with pain in the breast, cough, extreme wasting of the flesh, and hectic fever; the limbs grow tremulous and not uncommonly they become paralyzed, especially the lower extremities;[5] pains in the whole body are experienced, but

[1] NICHOLLS, St. George's Hosp. Reports, iv. 220.

[2] Edinb. Med. Ess. and Obs., iv. 41.

[3] N. York Med. Journ., i. 169.

[4] VIRCHOW'S Archiv, xxxiv. 73.

[5] Dr. GIBB (Trans. Path. Soc., Lond., ix. 442) has reported the case of a lady in whom these symptoms, and especially neuralgia and paraplegia, appeared to be due to the long-continued use of small doses of arsenic.

are very constant in the hands and feet, and are a source of extreme suffering; stiffness and contraction of the extensor muscles of these parts succeed, numbness gradually invades the extremities, and the mental faculties subside into insensibility and torpor; œdema of the face and extremities, and even general anasarca, are not unusual; at the same time the hair falls out, the epidermis scales off, pustular and other eruptions ending in ulceration attack the skin, which assumes a lifeless, earthy hue, the countenance, if not œdematous, is sunken, the conjunctiva is strongly injected, and a reddish circle surrounds the eyes. Such phenomena are most frequent among workmen engaged in the sublimation of arsenical ores.

The symptoms of *acute arsenical poisoning* may be thus described: Immediately after the poison is swallowed, a metallic taste is perceived with constriction of the fauces. A violent burning pain, which soon becomes excruciating, is felt in the stomach, and gradually extends itself over the whole abdomen, steadily increasing in severity until it becomes intolerable. Retching and vomiting, and cramps of the bowels, ensue, with spasms of the œsophagus and chest, which resemble those of hydrophobia. The thirst is insatiable, but even the mildest drinks cannot be retained; the tongue is generally fissured, hard, and dry, although occasionally there is profuse salivation, and the voice is hoarse. There is also tenesmus, with bloody and offensive stools, and retraction of the abdomen. The irritation is propagated to the urinary organs, occasioning, in the male, tumefaction of the penis, and in both sexes strangury. Sometimes the urine is completely suppressed, and sometimes it is mixed with blood. Prof. Christison says that in the female there is burning pain in the vagina, and excoriation of the labia, "but this does not happen unless life is prolonged beyond three days." Bachman had previously noticed the pain alluded to, and also profuse menorrhagia, among the symptoms in females. The muscles are spasmodically affected; the skin presents a livid eruption of the species already mentioned. The sense of anguish is unutterable, and sometimes there is delirium. The breathing is oppressed. The pulse is irregular, and intermittent, and is sometimes rapid; the action of the heart is tumultuous.[1] A consuming fire appears to prey upon the vitals, while the skin is everywhere pale, cold, shivering, and clammy. The features are sunken and sharp; if vomiting occurs, it is convulsive and affords no relief. Exhaustion of mind and body, prostration and despair, with anxious restlessness, generally attend this stage of the attack. On the approach of death, spasm yields to general resolution, the pulse grows slow and feeble, and the urine and fæces are voided involuntarily; but sensibility and consciousness are lost only in the last moments of life.

The duration of the symptoms is variable, and may be stated in

[1] According to BOEHM, when arsenious acid is injected into the veins of an animal it causes "an enormous decline of the blood-pressure, and slowing of the pulse."

general at from six to twelve hours; but occasionally they last for several days. Sometimes, also, though rarely, a fatal termination takes place almost immediately after the poison is swallowed, and without other symptoms than slight fainting fits. Dr. Christison has collected fourteen or fifteen cases of acute arsenical poisoning in which the signs of inflammation, after death, were slight, or altogether wanting, and the fatal issue occurred in five or six hours, with symptoms denoting "a powerful debilitating influence on the circulation, or on the nervous system."[1]

Even when recovery follows the complete development of acute arsenical poisoning, it is seldom perfect. For months, or even years, the joints of the limbs remain swollen and stiff, so as to render walking difficult and painful; the digestive organs for a long time continue irritable and feeble, and all of the functions of the nervous system are impaired. In some cases there is more or less paralysis of the upper or lower extremities, and in others gangrenous ulcers attack the legs. Arsenical paralysis most frequently affects the lower limbs first, extending gradually to the arms; but it is more permanent in the legs, continuing for months or even years. It is accompanied with cramps, spasmodic movements, numbness, and formication. The cutaneous sensibility is impaired, and the patient generally complains of coldness in the parts affected.[2]

After death from arsenic, whether the poison be introduced by the mouth, the rectum, or the skin, the lesions are essentially the same. It is said that the muscles and the limbs become relaxed, and speedily lose their irritability; but Orfila asserts, on the contrary, that they are unusually rigid. The skin in many parts, but especially about the genital organs, is stated to have an ecchymosed appearance. The influence of arsenic on the putrefactive process is variously estimated by different writers. Thus Richter asserts that it promotes this change, while the greater number agree that it tends to retard it. It is said that the blood is generally dark and liquid, unless death has taken place very speedily; when excessive doses of arsenic have been taken, its local irritant operation is manifested upon the stomach, intestines, œsophagus, and even the fauces. The gastric mucous membrane is chiefly affected. It is of a dark brown, or of a deep crimson color, and sometimes ecchymosed; sometimes effused blood, or tough, coriaceous fibrin, is found upon its surface, and has been mistaken for a gangrenous eschar. If death is long delayed, ulcers, or more properly erosions, may exist. The consistence of the membrane is generally diminished. In some cases, those in which the symptoms resemble nervous prostration, there may, as has already been intimated, be a complete absence of gastric lesions. Several cases of the sort are referred to by Orfila. The lungs are highly congested, and the tracheal mucous membrane is very red. The heart is usually filled

[1] On Poisons (Am. ed.), p. 241.
[2] R. Leroy D'Etiolles, Bull. de Thérap., lii. 230.

with blood, which stains its lining membrane. In the case reported by Virchow of a man who had swallowed a tablespoonful of powdered white arsenic and who survived for eight hours, no ulceration whatever was found in the stomach, although the gastric mucous membrane was red and swollen.[1]

The dose of arsenic sufficient directly to cause death will depend in a great measure upon the condition of the stomach when the poison is swallowed. If it contain much food, a very slight effect may be produced by a large dose of the poison. A case occurred to Oesterlen, in which a quarter of an ounce of arsenic was swallowed by a man, who just before had eaten and drunken heartily. Emetics, etc., were immediately administered, and no evil consequences ensued.[2] Mr. Godfrey has reported the case of a woman who swallowed about a dessertspoonful of arsenic immediately after a copious dinner. Vomiting did not occur, nor were any remedies administered for an hour and a half. Within five days complete recovery had taken place.[3] A case published by Dr. W. C. Jackson, seems to show that the stomach may sometimes appear to be comparatively insensible to the action of the poison. A quantity of arsenic, estimated at two ounces, was taken when the stomach was empty; there was great heat in this organ and in the throat, and irritability of the former after the active use of emetics, but within twenty-four hours even these symptoms had nearly disappeared.[4] On the other hand, very small doses may produce violent and even fatal symptoms. This is particularly the case when an arsenical solution is taken. Under such circumstances, four, three, and even two grains of the mineral have destroyed life.

Modus Operandi.—The caustic operation of arsenic demonstrates how readily it enters into combination with the constituents of the body. Its detection in so many of the organs and secretions, and the symptoms which it occasions in the former, render evident its wide diffusion through the economy. The fact that, however introduced, its effects are essentially the same, and that it frequently, when swallowed, is fatal without producing any gastric lesion whatever, proves, also, that its action is not merely local. Further, this presumption is sustained by all the phenomena of chronic arsenical poisoning. The gastro-intestinal symptoms usually produced by arsenic in the human subject, and in animals poisoned by it, even when it is applied to the skin, show that it seeks an outlet from the system by the bowels; while the fatal cases just alluded to, in which no gastric lesion was produced, prove, on the other hand, that its chief morbific (and curative) operation is upon the system at large. These facts and conclusions point to the blood as the probable seat of the changes upon which its sensible effects depend. Morgagni, and after him Wepfer, Jæger, Brodie, and others de-

[1] VIRCHOW'S Archiv, xlvii. 524. The striking similarity of the lesions of acute arsenical poisoning to those of Asiatic cholera, etc., are illustrated in this article, and also by HOFFMANN, ibid., l. 455.

[2] Heilmittellehre, 4te Aufl., p. 209.

[3] Lancet, Aug. 1857, p. 114.

[4] Am. Journ. of Med. Sci., July, 1858, p. 77.

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scribed the dark syrupy condition of the blood after arsenical poisoning, but, as before intimated, this condition is not present in all the cases. The microscopical and chemical peculiarities of this fluid under the action of arsenic are of great importance in relation to the changes which the solids undergo, to the hemorrhages from the nose, the digestive canal, the urinary passages, to the ecchymosis found in the lungs, pleura, pericardium, and heart, and to the occurrence of dropsy during the use of this medicine. The production of serous effusions as an ordinary effect, and of chronic anæmia as the consequence of prolonged exposure to arsenical influences, appear to furnish grounds for believing that in sufficient doses, arsenic, like mercury, tends to disintegrate the blood-corpuscles, to diminish the proportion of fibrin, and possibly, also, to attack still more directly the vital principle upon which the normal qualities of the blood depend. This theory is not inconsistent with the results obtained by the administration of arsenic in minute doses, and which have led to a tonic virtue being attributed to it. In such doses it unquestionably stimulates the stomach, either by its direct action or by its secondary operation and probably at the same time promotes the secretion of the liver, pancreas, and mucous glands. If so, it does what all condiments are intended to effect, facilitate digestion, and by that means improve nutrition. Indeed, arsenic has, with the irritant condiments (pepper, mustard, ginger, etc.), this common quality, that when the habit of using it is suspended, digestion languishes, and the health declines.

If we attempt to form a general idea of the mode of action of arsenic in medicinal doses, we shall probably feel justified in concluding that it radically modifies the function of nutrition, and hence is fully entitled to be ranked as an alterative. It is held by some authorities to directly restrict oxidation of the tissues, particularly of the fat. According to Schmitt it retards the waste of the red blood-corpuscles, and diminishes the exhalation of carbonic acid and the excretion of urea. Stürzwage estimated that the rate of loss by tissue decomposition was diminished from twenty to forty per cent. under the operation of arsenic, and Lolliot found that the temperature of the body declined. It hence appears to have a close analogy in its action with that of alcohol, tea, coffee, and Paraguay tea, although unlike these agents it scarcely affects the cerebral functions. As Werber remarks, with special relation to the use of the drug by the Styrian mountaineers, as it limits the loss by tissue change, it maintains the strength especially for laborious mountain pursuits, and renders the breathing easier under such exercise; it also gives roundness to the angular figure, makes the skin soft and smooth, and increases the weight of the body. Arsenic is rapidly eliminated by all the secreting organs, by the liver, the kidneys, the mucous membranes, and the skin. Indeed, there is no mineral salt so rapidly eliminated as the salts of this medicine. As Mr. Hunt points out, no traces of arsenic could be found in the bodies of animals, to which doses of fifteen grains of arsenious acid had been given daily, three days after the last dose.

A gentleman who had been taking arsenic for a year on account of a cutaneous disease, died of typhoid fever; and although he had used the medicine until within a fortnight of his death, not a trace of it could be found in his body.[1] It is probably owing to the activity of all the eliminating functions in children, that a toxical action is so seldom produced in them by medicinal doses of arsenical preparations.

Remedial Employment. *As an Antiperiodic.*—The original experience with arsenic in the cure of intermittent fevers, by physicians in Germany, England, and America, has been too often confirmed by later observation, to permit a reasonable doubt being raised in regard to the reality of its virtues. It is not now enough, as it was in the time of Lemery and Geoffroy, to condemn the medicine without trial, on the ground of its poisonous nature. On such a ground the materia medica would lose nearly all of its most useful members. We shall endeavor to show what the real value of arsenic is in periodical diseases, by a concise abstract of the results which have attended its employment.

From Fowler's summary of his own experience it appears that 171 out of 247 cases of "ague" were radically cured by the arsenical solution; 45 were cured by Peruvian bark after the failure of the solution; and of the remainder the greater number had the fits suspended only for a time. The cures generally took place within four days from the time when the administration of the medicine was commenced. Withering cured 33 patients out of 48 by the solution alone; in the remaining 15 cases it failed entirely.[2] Willan prescribed it in about fifty cases of different species of intermittents, and "it succeeded almost instantaneously in every case."[3] It was found by Winterbottom to be equally successful in African intermittents at Sierra Leone, where he cured twenty-one cases of the disease by its use. Among these were two of the quartan type.[4] In Philadelphia it was early employed by Wistar, Griffiths, Barton, and Currie, the last-named of whom mentions that it was a common practice in the State of Delaware to give the Asiatic pills (composed of arsenic and black pepper) for the cure of agues.[5] In 1820 Dr. T. D. Mitchell found it more effectual than bark during an epidemic at Norristown, Pa.; but unless he gave Fowler's solution in doses of fifteen or twenty drops his patients derived no benefit from its use.[6] Eberle was of opinion that it is best suited to the cure of the disease "in persons of a firm and healthy constitution, and most apt to act injuriously when given in a debilitated, cachectic, and irritable state of the system." In France, Desgranges and Foderé, the former in 1807, and the latter in 1809, attempted the introduction of arsenic as a substitute for cinchona, which owing to the wars which then ravaged Europe and destroyed its commerce, had become extremely scarce. In England, as late

[1] Journ. of Cutaneous Med., ii. 149.
[2] Appendix to Fowler's Treatise.
[3] Miscell. Works, p. 466.
[4] Med. Facts and Obs., vi. 1.
[5] View of the Diseases, etc., 1811, p. 34.
[6] EBERLE's Thérapeutics, 6th ed., p. 254.

as 1833, we find Dr. Joseph Brown stating that he had given the arsenical solution in many hundreds of cases, without witnessing any permanently ill effects produced by it. He ranks the medicine below bark and quinia, but states, what general experience has now confirmed, that cases are met with, which, having proved rebellious to one of these medicines, will be cured by the other.[1]

In despite of these and many other similar proofs of its efficacy, arsenic did not succeed in supplanting cinchona as a remedy for periodical fevers, and it gradually ceased to be used for this purpose, except in certain chronic cases, which were found intractable to bark. The discovery of quinia and its salts served still further to throw arsenical preparations into the background, and we should probably not again have heard them proposed, as a general means of treatment, had not the supply of Peruvian bark threatened to fall short of the demand for this precious drug.

In 1845 M. Boudin, a French military surgeon, addressed a communication to the Academy of Medicine, in which it was stated that during the previous five years he had treated 2947 patients with arsenical preparations, and had never met with any accident attributable to the medicine. His patients were treated in Senegal, Algeria, Syria, Italy, Corsica, Marseilles, and Strasbourg, at all seasons, and at every period of life. He gave arsenious acid the preference over the arsenite of potassa, and administered it in doses of one-fifth of a grain dissolved in about three ounces of distilled water. Three doses were generally prescribed in anticipation of the paroxysm, at intervals of two hours, and so that the last dose should precede the attack by three or four hours. Once the fever was arrested, a single dose was administered daily for about a week. By this plan M. Boudin found that the whole duration of the treatment was generally short, and that relapses were much less frequent than after the use of bark and its preparations.[2] In like manner Maillot and Masselot, the former at Lille, and the latter at Versailles, used this remedy with good effect, and a number of physicians both in Germany and France imitated their example.[3] M. Frémy treated 361 cases of ague, of which 106 were cured by arsenic without having been subjected to any other treatment, and 158 after quinia had failed. He conceived it to be most applicable to chronic cases, and especially to those which had resisted the preparations of bark.[4] Several observers declare that during the continuance of a periodical fever the patient manifests a decided tolerance of arsenic, and that the same dose, continued after the arrest of the attack, is very apt to occasion a loss of appetite, gastric distress, and other symptoms of irritation.[5]

On the other hand, several authorities of equal weight set a much lower value upon this plan of treatment. In 1849 and 1850, Jacquot made trial of the arsenical treatment in 282 cases of intermit-

[1] Cyclop. of Pract. Med., ii. 226. [2] Bull. de l'Acad. de Méd., x. 1010.
[3] Archives Gén., 4ème sér., x. 121, 456, and xi. 56; where the reader will find all that can be said in favor of the arsenical treatment of intermittents.
[4] Times and Gaz., Sept. 1857, p. 302. [5] Annuaire de Thér., xxii. 110.

tent fever occurring at Rome, and his conclusions were decidedly adverse to its utility. In particular, he remarked that it is not allowable to substitute arsenic for quinia in the treatment of the malarial fevers of warm climates, because the attacks are often grave, and require to be met by a large dose of the specific remedy, which in the case of arsenic would be unsafe or impracticable. He concludes that arsenic is only allowable in chronic cases which have resisted quinia.[1] M. Gintrac, of Bordeaux, after giving an impartial summary of the experience of other physicians on this subject, and showing that the weight of testimony is decidedly adverse to a belief that arsenic is comparable to quinia as an anti-periodic, presents the results of his own observations, which fully agree with those just stated.[2] Oesterlen, who, like Gintrac, employed arsenic in a locality where periodical fevers are endemic, found it far less effectual than bark or quinia;[3] and Clarus goes so far as to deny that it possesses antiperiodic properties at all, adding that he has so often seen it fail of curing, that he hesitates to admit the correctness of the many reports made in its favor.[4] Between the issue of the third and of the present (4th) edition of this work no new facts of importance have elucidated this subject, and, indeed, it appears to have lost again the interest it at one time excited.

Such, it is believed, is a candid statement of the evidence now before the profession relative to the influence of arsenic in intermittent fevers. In estimating its value, the fact should never be lost sight of that a large proportion of simple intermittents tend spontaneously to cure, if the patient but keeps his bed, avoids disturbing influences, and, above all, if he has faith in the curative virtues of whatever prescription he follows. When such conditions have been allowed to act for a few days, without the use of any active medicine, it will then be time enough to introduce the remedy whose virtues are to be tested. There is, we apprehend, no doubt that arsenic is altogether unfit for the treatment of the malignant forms, and incomparably inferior to quinia in recent attacks of intermittent fever. At the same time, it is perhaps equal to quinia in chronic forms of that affection, and it certainly constitutes a precious resource in the small proportion of cases which resist cinchona in all its forms and in every dose.

The rules for the administration of Fowler's arsenical solution in intermittent fevers are these: Children from two to five years old should take one-half a drop at a dose for each year of their age; between the ages of eight and twelve years the dose should be from two to four drops. Beyond this age, from three to five drops three times a day should be given for five days, then suspended for two or three days, and again resumed so as to prevent a relapse. If the paroxysm is not suspended in five days, and the injection of the conjunctivæ and the puffiness of the eyelids are moderate, it may,

[1] Archives Gén., 5ème sér., iii. 678.
[2] Pathologie et Thérap., iii. 698.
[3] Heilmittelehre, 4te Aufl., p. 212.
[4] Specielle Arzneim., p. 861.

if necessary, be continued for two or three days longer. If the disease is still unconquered, the arsenic had better be laid aside, and cinchona given in its place.[1] If the solution occasions diarrhœa with moderate griping, five or six drops of laudanum may be added to each dose for an adult. To delicate persons, only two doses a day should be administered, and in children under two years of age the medicine had better be avoided. Doses very much larger than those above suggested have been recommended by physicians of experience. Dr. Broderick, for instance, who cured one hundred cases of quotidian ague in India by means of this medicine, usually prescribed half a fluidrachm of Fowler's solution three times a day, a dose which appears to us excessive, and which in the case of the physician himself who recommended it "made him feel very sick and miserable."[2] Arsenic should never be given when the stomach is empty.

In some cases of local disease which assumes the intermittent form, this remedy has been of service. Darwin cured a case of regular *intermission of the pulse* by the administration of four drops of a saturated solution of arsenious acid three times a day.[3] It has also been used successfully for intermittent *gastrodynia*, and still more so in *periodical headache*. Of these cases some notice will be found below.

Diseases of the Skin.—For many centuries the Hindoo physicians have been in the habit of prescribing arsenic in very minute doses for the cure of certain scaly affections.[4] A similar statement is made by Sir William Jones. In the western world it does not appear by whom this treatment was first recommended. It is said by Mérat to have been used by Adair in 1783–4.[5] But some of its earliest successful applications to the cure of skin diseases were made in the United States, by Drs. Martin, of Maryland, and Potter, of Philadelphia,[6] as early as 1796. In 1804, Dr. Otto, of the latter place, cured an obstinate case of eczematous eruption and other skin diseases, with the arsenical solution.[7] Soon afterwards (1806) Dr. Girdlestone, of Yarmouth, England, published an account of his successful use of the remedy "in some hundreds of cases of lepra, lichen, psoriasis, tinea capitis, etc."[8] Subsequently it was employed and eulogized by Willan and Bateman in England, and by Biett in France, and these physicians soon found imitators of their practice and success. But, on the whole, its reputation in cutaneous affections rests upon its efficacy in scaly eruptions and in chronic eczema.

Cazenave and Schedel, following on the path of Biett, advise the arsenical solution as the best remedy for lepra and psoriasis.[9] Its first effect, they state, is an increased activity in the eruption,

[1] FOWLER, p. 88.
[2] Brit. and For. Med.-Chir. Rev., Oct. 1866, p. 528.
[3] HEADLAND, the Action of Medicines, p. 197.
[4] AINSLIE, Mater. Indica, i. 502, 641.
[5] Dict. de Mat Méd., i. 441.
[6] CALDWELL'S Medical Theses, p. 61.
[7] Philad. Med. Museum, i. 47.
[8] Med. and Phys. Journ., xv. 297.
[9] Abregé Prèt. des Mal. de la Peau, 2ème éd., 1833.

which grows redder and more irritable; then the central portion of the patches becomes healthier, the edges crack and gradually subside, and often in less than two months the disease disappears after a tormenting duration of several years. In a case published by Cazenave,[1] the patient, who for fifteen years had been afflicted with *psoriasis inveterata*, was cured in twenty-six days by means of Fowler's solution, and that without any constitutional disturbance whatever.

Yet, however prompt and decidedly curative this treatment sometimes is, its success is by no means uniform, and they who employ it should not be too profuse of their promises to cure. Emery, whose high authority will not be contested, says: "I have notes of 140 cases of psoriasis, or lepra vulgaris, treated by various arsenical preparations, and of this number only 38 left the hospital apparently cured, after a treatment of two, four, six, eight, and even fifteen months. In the course of eighteen months 22 of these patients returned with a renewal of the disease. Of the remainder, 40 were more or less benefited, and 62 experienced such various ill effects from the medicine that after eight or nine months of fruitless efforts, I was obliged to abandon it."[2] At the same time, Emery admits that, after all, arsenic is the best internal remedy for psoriasis, and by combining its use with the external application of tar ointment he obtained the highest degree of success. This, indeed, accords with general experience. The effects of a pure arsenical treatment were found by Gibert to be almost identical with those observed by Emery. Out of 98 cases subjected to this method, only 40 were cured, and 38 improved.[3] Dévergie prefers Fowler's solution to all other medicines in the treatment of scaly eruptions. He, however, does not think it of much utility in cases of inveterate psoriasis—those, for instance of ten years' duration or more. In its administration, he commences with two drops the first day, three the second, and so on until sixteen drops a day are taken, and he does not venture beyond that quantity. Indeed, he is of opinion that to support this dose the patient must be robust, and have sound lungs and a good digestion; otherwise the gastric functions become deranged, the appetite fails, and emaciation ensues.[4] If such risk attend the method here proposed, there is a strong objection to employing it, and we should very decidedly give the preference to that which appears to have been so efficacious in the hands of Mr. Hunt.[5] He maintains that the curative powers of the medicine reside only in doses too small to be mischievous, although sufficient manifestly to affect the economy. Instead of gradually increasing the dose from a very minute one, he advises to begin at once with the largest dose intended to be used, and to reduce, but not suspend, the medicine whenever redness of the tarsi begins to appear. Mr. Hunt has embodied his

[1] Journal Hebdomadaire (1828), i. 258.
[2] Bull. de Thérap., xxxvi. 481.
[3] Ibid., xxxix. 115.
[4] Maladies de la Peau, p. 100 et seq.
[5] Lancet, Jan. 1846, p. 77.

method of treatment in the following code of regulations, which we think of sufficient importance to be inserted here.[1]

1. The use of arsenic is contraindicated where there is a feverish state of the system, a quick pulse, hot skin, etc.

2. It should never be given on an empty stomach.

3. It should never be given in increasing doses. This is a fatal and almost universal mistake.

4. The largest dose ever required is five minims of Fowler's solution three times a day.

5. This, if mixed with the food, will not irritate the stomach or bowels, but will, in the course of a few days or weeks, produce an itching or smarting in the conjunctiva. This membrane will appear slightly inflamed, and the lower eyelid will soon become a little puffed or swollen. The cutaneous disease will now begin to decline, and the dose must be reduced to four minims.

6. If the conjunctiva continues much inflamed, the dose must be further reduced, but the conjunctiva should be kept tender throughout the whole course.

7. If the skin becomes more inflamed, the course must not be interrupted, but a few leeches must be applied to the margin of the diseased portions, or an occasional aperient exhibited.

8. The arsenical course must be continued for as many months after the final disappearance of the eruption as it had existed years before. This will prove a security against a relapse.

9. Cutaneous disorders treated in this way seldom return, and never severely, nor is there any danger of metastasis.

Chronic eczema is hardly a less obstinate disease than psoriasis. Biett is reported to have cured it with singular rapidity by means of arsenic. Rayer testifies that "the preparations of arsenic are sometimes the only medicines which are adapted to the inveterate form of the disease affecting the scrotum, the vulva, the verge of the anus, etc., when a complete cure is desirable;" and Mr. Hunt brings evidence of its curative power after the inflammatory symptoms of the attack have been subdued. These results are further confirmed by Dr. Handfield Jones.[2] We found it the only one of a great variety of remedies which promoted the cure of an inveterate case of this disease affecting the whole body.

Dr. Hunt gives the following enumeration of cutaneous diseases which are not benefited by arsenic, and of those which it is competent to cure; and we think his statement agrees with the results of general experience. 1. Arsenic is not useful in syphilitic diseases of the skin; in ephemeral and exanthematous diseases; scabies. 2. On the other hand, he declares, arsenic is not only useful, but essential, and almost unexceptionally successful when properly administered in all cases of chronic idiopathic affections of the skin; provided always, and in all cases, that it be administered discreetly,

[1] Prov. Med. and Surg. Journ., April, 1846; and BRAITHWAITE'S Retrospect (Am. ed.), iii. 74.

[2] RANKING'S Abstract (Am. ed.), xxiii. 113.

perseveringly, and with such adjuncts—purgatives, alteratives, tonics, or eliminants—as the case may require.[1] A case is on record in which it cured *chronic pemphigus* on several successive occasions, but did not prevent its return.[2] In another recorded case a similar result was attained, but the same remedy again removed the eruption.[3] Donovan's solution (*Liquor Arsenici et Hydrargyri Iodidi*) contains only one-quarter as much arsenic as Fowler's solution; but the union of arsenic with the other two great alteratives of the Pharmacopœia is supposed to impart peculiar virtues to the compound. It appears to be especially adapted to those cases of scaly eruption which are of syphilitic origin, hereditary or acquired. Apart from this complication, squamous affections of the skin are apt to be aggravated by the use of any preparation containing mercury. In *strumous ophthalmia* connected with impetiginous eruptions on the skin arsenic has been found superior to every other remedy by Oglesby.[4] Dr. Erasmus Wilson recommends the internal use of arsenic for the cure of *warts*, and we have seen more than one instance in which local treatment was unsuccessful in removing these unsightly and inconvenient excrescences until Fowler's solution had been administered.

Among other diseases for the cure of which arsenic may be given internally, is *chronic rheumatic arthritis*. As early as 1804, Mr. Jenkinson, of Manchester, used the arsenical solution in some cases of this affection, such as were afterwards described by Haygarth as "nodosity of the joints."[5] Bardsley thought "that it is only in the protracted chronic rheumatism, where the vital powers are much diminished, and the ends of the bones, periosteum, capsules, or ligaments of the joints, are likewise partially affected, that the use of arsenic is likely to prove eminently successful."[6] In the form of disease, to which Dr. Haygarth gave the name above mentioned, he found it of great service; and Dr. Christison says that he has known several cases of this affection get well under the continuous administration of arsenic for several weeks.[7] Eberle presents a similar account of its virtues, which he thought were very decidedly evinced in syphilitic rheumatism, but most of all in the form following "the imprudent use of mercury."[8] Similar attestations of the value of this treatment have been furnished by Fuller,[9] and Begbie.[10] Guéneau de Mussy treated nodosity of the joints successfully by means of prolonged warm baths containing from fifteen to forty-five grains of arsenite of soda, according to the existence of a febrile or an apyretic form of the disease.[11] Continued experience confirmed him in his original impressions of the utility of this method, but also induced him to associate with it the internal use of arsenious acid.[12] The same treatment was recommended by

[1] Journ. of Cutaneous Med., ii. 250.
[2] Lancet, Feb. 1859, p. 158.
[3] Times and Gaz., Jan. 1864, p. 10.
[4] Practitioner, ii. 288.
[5] Lond. Med. and Phys. Journ., xi. 492.
[6] Med. Reports, p. 32.
[7] Dispensatory (Am. ed.), p. 252.
[8] Therapeutics, 6th ed., p. 255.
[9] Ranking's Abs. (Am. ed.), xxv. 37.
[10] Loc. inf. cit.
[11] Bull. de Thérap., lxi. 189.
[12] Ibid., lxxii. 241.

Beau.[1] We have employed arsenic as an internal medicine in several cases of nodosity of the joints, and for several months consecutively, but it did not appear to exert the slightest influence either in mitigating the pain or in diminishing the swelling of the affected parts.

Chorea is an affection which is often more amenable to arsenic than to any other remedy. Many years ago, Mr. Salter reported four cases of the disease cured by giving three drops, three times a day, of Fowler's solution, and gradually increasing the dose.[2] Mr. McLeod says that when carbonate of iron fails to cure chorea, he has "recourse to the liquor arsenicalis, and with invariable or almost invariable success."[3] Dr. D. M. Reese, of New York, stated "that he employed arsenic in over two hundred cases of chorea without failing in a single instance in effecting a radical cure."[4] Romberg says he learned by an experience of several years that foremost among the remedies which are able to arrest the disease in a short space of time is arsenic, in the form of Fowler's solution;[5] Mr. Aran published a case of unilateral chorea cured by arsenious acid, and he regarded the medicine as peculiarly applicable in the anomalous and obstinate forms of the disease.[6] Dr. D. Rice, of Massachusetts, informs us that during a period of five years he cured all his cases of chorea in from two to six weeks by the use of Fowler's solution,[7] and Dr. Begbie declares that arsenic holds the foremost place among the various remedies employed in the cure of chorea.[8] Dr. T. K. Chambers is of the same opinion,[9] suggesting, as to its mode of action, that arsenic not being a normal constituent of the body "it must be an indirect constructive, acting powerfully on the nervous system."

Neuralgia.—The intermittent form of neuralgia is that to the cure of which arsenic is peculiarly adapted, and certainly, in cases that have resisted the power of quinia, it may be employed with great hopes of success. Fowler, in his Essay, reports seven cases, showing the efficacy of arsenic in this disease when it arises from a malarial cause. But its power, although most distinctly manifested in such cases, is not confined to them. An instance of that terrible form of internal neuralgia which constitutes one of the varieties of angina pectoris, has been published by M. Garin, of Lyons, and in it arsenious acid effected a cure when everything else had failed to afford relief.[10] A very similar example of the same disease cured by Fowler's solution was long ago reported by Alexander.[11] In neither case were the paroxysms regularly intermittent. A violent neuralgia of the supra-orbitar and other

[1] Annuaire de Thér., xxvi. 267. [2] Med.-Chir. Trans., x. 219.
[3] Lond. Med. Gaz., Jan. 1836, p. 651.
[4] Note to Am. ed. of Copland's Dict., art. Chorea.
[5] A Manual of the Nervous Diseases of Man (Syd. Soc. ed.), ii. 73.
[6] Bull. de Thérap., 1856, l. 289; lvi. 257.
[7] Boston Med. and Surg. Journ., Feb. 1858, p. 77.
[8] Edinb. Med. Journ., iii. 972. [9] Lectures (Am. ed.), p. 394.
[10] Bull. de Thérap., xlviii. 351. [11] DUNCAN'S Commentaries, 1789, xv. 373.

branches of the fifth pair, resulting from a wound and fracture of the right frontal protuberance made by a dagger, is reported to have been cured by arsenious acid, after the failure of other remedies.[1] To these evidences in favor of the remedy may be added the testimony of Macculloch, who says that he found it more generally efficacious in neuralgia than in intermittent fever, for it often acted like a charm on the pain, even in cases of many years' duration.[2] Romberg, speaking of the treatment of facial neuralgia, says: "The united testimony of various observers agrees in according to arsenic the chief place among metallic preparations; but it will not do to rest contented with such timid doses as might be worthy of a homœopathic quack. It must be exhibited in increasing doses, from three to ten drops of Fowler's solution, two or three times daily; it should be persevered in until the toxic effects show themselves, in sickness, a sense of fainting, formication in the toes and fingers, dryness of the fauces, and white tongue; then a pause should be allowed, and the solution resumed as soon as those symptoms have subsided."[3] In the Jewish Hospital of Paris, Cohen successfully treated sixty-five cases of various forms of neuralgia with arsenious acid in daily doses varying from $\frac{1}{65}$ to $\frac{2}{3}$ of a grain. Among them were many cases of gastralgia.[4] Millet furnishes an equally favorable account of the operation of the remedy, saying that "the patients speedily cease to suffer, and rapidly regain a vigorous appetite even when it has long been lost."[5] Dr. Leared has called attention to the virtues of arsenic in *gastralgia*,[6] and some confirmation of his statements were furnished by Dr. C. H. Jones and by Dr. Anstie. Subsequently he defined the cases in which the remedy is useful, as follows: "If the disease comes on after some mental shock or severe trial, if the patient has suffered unmistakably from neuralgia, if he has lived in a marshy district, and if the pain be paroxysmal, it will almost certainly yield to arsenic."[7] Nevertheless several cases which he describes are of quite a different nature, probably of simple ulcer, and one indeed is admitted to be such. The same may be said of the cases published by Dr. Thorowgood as relieved by arsenic, and which he describes under the name of "irritative dyspepsia." It is possible that chronic inflammation of a superficial sort, and even chronic ulcer, may be benefited through the improved nutrition which arsenic induces. It is probable that gastralgia, like other neuralgic affections, is cured by arsenic through such an operation. In all such disorders the medicine should be used in very small dose and exclusively after meals.

Diseases of the Lungs.—In certain cases of shortness of breath, which, however, are not well determined, arsenic appears to be of service. The ancient use of sulphuret of arsenic for asthmatic affec-

[1] Journ. Compl. des Sci. Méd., xii. 327.
[2] On Marsh Fever and Malaria, ii. 377.
[3] Op. cit., i. 53.
[4] Bull. de Thérap., lxvi. 90.
[5] Annuaire de Thér., xxvi. 260.
[6] BRAITHWAITE's Retrospect (Am. ed.), lvii. 76.
[7] Times and Gaz., July, 1870, p. 94.

tions has already been noticed, and it may now be added that, according to Moschati,[1] the mountaineers of Dalmatia and Albania are in the habit of employing the inhalation of arsenical vapors in chronic disorders of the lungs. Some cases illustrative of its use in such affections, have been published of late years, but are not very conclusive as to the efficacy of the remedy. Millet, who employed it extensively, believes that it is destined to be of great service in this disease, but furnishes no proofs of its past efficacy. Trousseau found that in *tuberculous phthisis* it sometimes suspended the progress of the disease in a remarkable manner. He gave arsenious acid in doses of $\frac{1}{25}$ to $\frac{1}{4}$ grain, and caused his patients to smoke cigarettes made of paper saturated with a solution containing half a drachm or a drachm of arsenite of soda, in three drachms of water. Such inhalations, we should suppose, might be mischievous unless closely watched. In 1868 Moutard-Martin published a paper upon this subject which concluded as follows: "In hospital practice arsenic often produces radical alterations in the state of consumptive patients, giving them strength, appetite, and flesh, and when the disease is not too far advanced or is not of the acute type, it often palliates the symptoms of even the most advanced stage. Some rare cases, even, show its power to cure."[2] This paper was the subject of a Report to the Academy of Medicine, by M. Hérard, who fully sustained its conclusions, and presented rational grounds for accepting them as true.[3] Several other physicians have been profuse in stating rational grounds for the efficacy of the medicine, but have given very little clinical evidence of its virtues in curing pulmonary consumption. When the digestive powers are feeble, and emaciation is progressive, there is no doubt that, like various other medicines, it may improve the digestion and delay the downward course of the disease, especially if given in very small doses, such as one drop of Fowler's solution after each meal; but whenever there is a tendency to irritable stomach or to diarrhœa, it is positively contraindicated. Its direct effect upon the lungs is shown chiefly in a diminution of the expectoration. This operation is clearly manifested in the treatment of *chronic bronchitis*, especially when long-continued purulent secretion has given rise to a hectical condition. In such cases we have found it of striking utility, when associated with the compound iron mixture. In both of these affections when the dyspnœa is marked, arsenic becomes a most eligible remedy, provided no contraindication exists in the condition of the stomach. This clinical fact harmonizes with the experimental results already described which indicate that arsenic diminishes the oxidation of the tissues. Dr. Gutteridge states that in a case of *angina pectoris* which was proved after death to depend upon structural cardiac lesions, especially of the muscular tissue, nothing gave so much relief during the par-

[1] HARLES, op. cit., p. 106. [2] Bull. de Thérap., lxxv. 385.
[3] Bull. de l'Acad. de Méd., xxxiii. 983.

oxysms as "full doses" of "liquor arsenicalis" repeated every five, ten, and fifteen minutes.[1]

Uterine Disorder.—Dr. Hunt mentions that he was successful in curing a number of cases of *menorrhagia*, which he publishes at length.[2] In most of them the hemorrhage appears to have depended upon a feeble rather than a sthenic condition of the uterine system. He employed Fowler's solution, and also arsenious acid; of the latter the dose prescribed was $\frac{1}{30}$th of a grain three times a day. Dr. Locock, from whom Dr. Hunt originally derived the suggestion for using this remedy, found it advantageous not only in atonic menorrhagia, but also in the acute form of the affection after depletion had been resorted to.[3] Dr. Aveling has added his testimony in its favor.[4] Dr. Hunt found arsenic a valuable remedy in *dysmenorrhœa* and *leucorrhœa*, and in all forms of uterine disorder associated with rheumatism. Dr. Simpson used it successfully in *amenorrhœa*, as well as in that peculiar affection of the bowels characterized by a copious discharge of membranous shreds, and accompanied by great emaciation, and a long train of neuralgic and other nervous symptoms.[5]

M. Imbert-Gourbeyre has drawn attention to the great utility of Fowler's solution in the treatment of *vulvar pruritus.*[6]

The idea of treating *diabetes* with arsenic seems to have originated with Devergie, who in 1864, speaking of prurigo of the female genital organs, remarked that it is frequently associated with a saccharine state of the urine, and that several times arsenic had cured both diseases at the same time. He also stated that he had cured diabetes by arsenic alone. In 1864 Dr. Rees published a case in which arsenic proved beneficial when all other means had failed.[7] In 1868 Foville claimed that "arsenic is one of the best means of suspending the symptoms of diabetes, and of diminishing the proportion of sugar in the urine or of quite eradicating it.[8] Jaccoud[9] states that in some cases for which strychnia had proved unavailing, he succeeded in reviving the nutritive function and arresting the discharge of sugar by means of an appropriate diet and arsenious acid in the dose of one milligramme ($\frac{1}{60}$ gr.). Leube has reported two cases of interest. With a mixed diet, and without arsenic, the daily average of sugar was 570 grammes in one case; arsenic reduced it to 352 grammes, on the average of 79 day and night observations. In the other case the same result was obtained.[10] On the other hand, Browardel[11] gives the history of three cases in which this treatment signally failed to be of the slightest advantage. It is, nevertheless, certain that arsenic is a remedy not to be neglected in the treatment of diabetes. Where no remedy is of absolute efficacy, but many are useful, the number of the latter cannot be too great.

[1] Glasgow Med. Journ., iv. 67.
[2] Med.-Chir. Trans., xxi. 277.
[3] Lancet, April, 1838, p. 93.
[4] Brit. Med. Journ., Jan. 1872, p. 10.
[5] Edinb. Med. Journ., iii. 978.
[6] Times and Gaz., p. 505.
[7] Lancet, Sept. 1864, p. 436.
[8] Prix Civrieux, 1869.
[9] Pathologie Interne, ii. 892.
[10] Practitioner, ii. 308.
[11] Les Diverses Médications employées contre le Diabete Sucré, 1869.

Arsenic has been used in various other affections, as *whooping-cough*, *epilepsy*, *tetanus*, *furunculus*, *snakebites*, *dropsy*, etc., but its efficacy in all of these affections is too uncertain to entitle it to confidence.

External Application. Cancer.—It may be proper to premise a few words respecting the use of arsenic as an *internal* remedy for this disease. Harles recites the names of many distinguished physicians who used it with marked success, and among them Lentin, Frick, Tode, Adair, and Roennow. The last mentioned is said to have employed this treatment for more than forty years, and to have cured thirty cases of well-marked cancer. He, however, also employed arsenical caustics. Mr. Hill extols the medicine in a great variety of diseases, as well as cancer, and with so little measure as to weaken our faith in his judgment respecting the latter. He states, however, that certain tumors presumed to be scirrhous, and certain ulcers believed to be cancerous, occasionally amend or are removed by the use of arsenic. The judgment of Dr. Walshe, in respect to the *iodide of arsenic*, is of sufficient importance to be quoted here. This compound was introduced by Dr. A. T. Thomson, who supplied the earliest evidence of its favorable influence on cancer. Since then, says Dr. W., "I have used it in several cases, from which (in the greater number, other but not equally energetic means were simultaneously employed) I feel myself justified in drawing the following inferences as to its effects. It is to be premised, that in all these cases, the species of cancer treated was scirrhus in the non-ulcerated stage, that the breast was the part affected, and that the constitution had in some begun to suffer seriously. 1. Given in doses of one-sixteenth to one-twelfth of a grain twice daily, two hours after eating, the iodide of arsenic is well borne, and may be continued without risk for several months. 2. The system generally soon gives evidence of its action—unusual perspiration with dryness of the fauces and alimentary canal occur. Sometimes slight headache is complained of, but this is rare; and I have known most violent periodical headache, which had afflicted a lady for years, disappear while she was under the influence of the salt. 3. The pain of the tumor increases in violence. 4. The size of the breast generally diminishes; and if the tumor itself does not actually lessen in bulk, I have at least found that its enlargement, previously more or less active and apparent, becomes, as far as can be determined, suspended. 5. The general health improves."[1] These conclusions, considering the source from which they emanate, are entitled to serious consideration, and both warrant and encourage the use of the remedy in the cases referred to.

The use of arsenic as a *caustic* is of ancient date. Celsus recommends orpiment, lime, and chalcites, in gangrene of the penis;[2] and in the sixteenth and seventeenth centuries, it was used in the topical treatment of cancer by Fernel, Fallopius, Mayerne, Guy de

[1] The Nature and Treatment of Cancer, p. 201. [2] Book VI. chap. 18.

Chauliac, and others.[1] Some employed it much diluted to improve the action of the ulcerated surface, and others as a caustic to destroy the cancerous structure. The cancer paste of Frère Côme consisted of cinnabar, ʒij; ashes of old leather, gr. viij; dragon's blood, gr. xij; arsenious acid, ʒij. These ingredients were brought to a proper consistence with water, and then applied in a thin layer over the whole surface of the cancerous ulcer, previously dried with lint. It occasioned severe pain and great inflammation, after which a slough formed, and was thrown off in the course of two or three weeks. If the resulting wound did not heal, the operation was repeated, and this was sometimes done several times in succession. Rousselot's powder consisted of two drachms of arsenious acid, mixed with two of the bisulphuret of mercury, and the same quantity of dragon's blood. In recent times Dupuytren was in the habit of using a powder composed of ninety-nine parts of calomel to one of arsenious acid; the latter was sometimes increased to five or six parts in the hundred. From time to time the treatment of cancer by arsenical paste, after having been laid aside by surgeons, acquired a certain vogue through the reports of cures wrought by its use in the hands of irregular practitioners. Thus, Dr. Rush gives an account of a medical quack, who was said to be very successful in the treatment of cancer by means of a powder which was found to contain arsenic. It is, however, particularly stated that these cancers were seated upon the nose, cheeks, and surface of the body or extremities, and not in the neck, breast, or axilla. Hence it is possible that they were cases of lupus merely. A similar account is given by Dr. Thomas Sewell, who was persuaded of the curative virtues of the application.[2]

In regard to the value of arsenical caustics in cancer, Dr. Walshe remarks: "That arsenical preparations have with some frequency effected a cure of cancerous ulcers in the manner described is a fact concerning which no doubt can be held." But, after mentioning that the paste causes a slough which separates in from two to six weeks, and that sometimes a second and third application of it is required, he continues: "The dangers increase to such a degree that it is now a matter of received doctrine that these preparations should only be used in cases of superficial cancer." Indeed, it is certain that numerous persons treated by their means have perished miserably from pain, inflammation, or hemorrhage following the application. It is difficult to perceive what advantage the tedious and very painful operation of caustics can possess over the speedy and less painful action of the knife, and least of all since the use of anæsthetics has done so much to deprive the surgeon's hand of its terrors. Yet the use of caustics for cancer has always been and continues to be a favorite field for the manœuvres of quackery, and hardly a community exists that has not furnished one or more victims of its cruel operation.

In the treatment of *lupus*, which is a tuberculated scrofulous

[1] Richter, op. cit., v. 146. [2] N. England Journ. of Med.,

inflammation of the skin, several caustics are employed, such as the Vienna paste, the chloride of zinc, and the acid nitrate of mercury, but when the tubercles are large it is necessary to select one that acts powerfully and deeply, but not to apply it upon an extensive surface, for fear of the danger of arsenical poisoning. M. Lebert relates that Pope Gregory XVI., having a cancroid ulceration of the nose, which the Roman surgeons were unable to heal, M. Allertz, of Aix-la-Chapelle, was consulted, and was successful in producing its complete cicatrization. It appeared afterwards that he employed the arsenical paste of Frère Côme, which had previously been used, but less thoroughly.[1] If this caustic is selected, it should be very cautiously applied over the nasal cartilages. Its action is very painful; it occasions an erysipelatous inflammation for several days, and for a week the patient may expect to enjoy no sleep. The eschar falls between the tenth and the fifteenth day, and generally leaves a healthy granulating surface.

Treatment of Arsenical Poisoning.—The following precepts have reference especially to the most usual form of arsenical poisoning, that by arsenious acid. The first care should be to procure the discharge of the poison from the stomach, and as far as possible, by means of remedies which will not irritate the mucous membrane of this organ or depress the system. The emetics to be preferred are ipecacuanha, in doses of from twenty to forty grains, alum, or the sulphate of copper or of zinc, and their operation is to be promoted by large draughts of tepid and demulcent drinks, such as mixtures containing the white of egg, milk, flour, oil, animal broths, lime-water, etc., which serve, in some degree, to envelop the poison and shield the membrane. Their action should be further promoted by tickling the fauces, and then, if vomiting does not take place freely, the stomach should be thoroughly washed out by means of the stomach-pump. Having thus, as far as possible, removed the poisonous substance, those preparations may be administered which are supposed to enter into chemical combination with the arsenic and render it inert. Of these the one most commonly employed is the hydrated sesquioxide of iron, which must be given in very large doses to be efficient. A tablespoonful every five or ten minutes is the dose recommended. It combines with the dissolved portion of the acid, and in the vomiting which its bulk occasions, an additional portion of the poison may be discharged. The hydrated sulphuret of iron (*sulfure de fer hydraté*) has been proposed by Mialhe as superior in efficacy to the hydrated sesquioxide.[2]

Magnesia, when finely calcined, or, still better, when prepared by precipitation from its solutions in the form of a hydrate, has also been recommended as an antidote to arsenic, and so have animal charcoal and lime-water. How far the operation of any of these preparations is chemical, and how far it is merely mechanical

[1] Maladies Scrofuleuses, p. 263. [2] Chimie Appliqu

enveloping the poison and delaying or preventing its contact with the walls of the stomach, is far from being satisfactorily determined. It is, perhaps, not unworthy of consideration that they must tend, by their direct action upon the gastric mucous membrane, to promote, or even to cause, its inflammation, and hence it would seem that a certain moderation, with reference to the violence of the symptoms, ought to be observed in administering them.

After having carried the use of these means as far as the exigencies of the case require, it is usually advised to direct a dose of castor oil for the purpose of expelling from the bowels whatever portion of the poison they may still contain. At the same time, if the surface of the body is cold, it should be briskly rubbed, and dry heat applied to it by means of heated sand, bottles or other appropriate vessels containing hot water, etc. This is also the period when stimulants may be resorted to. Of these, opium and alcoholic liquors are the most important. The utility of the former is sometimes very decided by relieving the pain and sustaining the strength, and, perhaps, also by diminishing the rapidity of the absorption of the poison. It should be given in doses adapted to stimulate but not to narcotize the patient, that is to say, in small quantities repeated at short intervals. This intention will be promoted by wine or brandy administered along with the opiate or in the intervals between the doses of the latter.

It is sometimes advised to use depletion, both local and general, to combat the inflammation of the stomach, but however clear the indication for an antiphlogistic treatment may be, if drawn merely from the physical condition of this organ, there is in reality a state of the system which takes precedence of the local derangement, and calls more imperatively for relief. The symptoms in fatal cases are often those of depression and a tendency to collapse. If these are not combated the patient must die, under the combined pressure of the local and the constitutional poisoning; but if the system is upheld until the violence of the attack has spent itself, the restorative power of nature can be exercised with less restraint.

IODINIUM.—Iodine.

Sources. Preparation.—Iodine is one of the most widely disseminated of the elementary bodies. According to M. Chatin it exists in rain water and in the atmosphere.[1] It is found in every kingdom of nature, but most abundantly in plants which grow upon the seashore, and in marine zoophytes. Among the products of the ocean the natural family of *Algæ* furnish it most abundantly, and those which inhabit deep water possess it in the largest proportion. It has been detected in many fresh-water plants (*confervæ*), and in several land plants or their products, and particularly in the

[1] Bull. de l'Acad., xxiii. 346.

agave mexicana. Among animals, those of the genus *Spongia*, and a great number of shell-fish, are rich in this product. It has also been found in eggs, in milk, especially of the ass, in cod-liver oil, and in human urine. An insect met with in Italy, *Julus fœtidissimus*, emits, when disturbed, a yellow fluid smelling strongly of iodine, and which immediately strikes the characteristic violet color with starch.[1] Iodine exists, also, in various mineral springs of Germany, Italy, France, and other parts of Europe, especially in those of Heilbronn, Kreuznach, Saleset, Cauterêts, and Barêges. In the United States the iodine spring of Saratoga is said to contain 3.5 grains of iodide of sodium to the gallon of water. It also exists in the Kenhawa saline waters, and in those of western Pennsylvania.

The iodine of commerce is procured from *kelp*, *i. e.*, the ashes of sea weeds, by mixing them with water and evaporating the solution until all the saline matters contained in the lixivium are precipitated except the iodide of sodium. The solution is then acidulated with sulphuric acid and distilled with deutoxide of manganese. The reaction between these several bodies results in the evolution of iodine, which is condensed in appropriate receivers, while sulphate of sodium and sulphate of the protoxide of manganese remain behind. The iodine thus procured is purified by washing and a second sublimation.

Properties.—Although crystallizable, iodine is generally in the form of opaque, soft, and friable scales, of a dark leaden color and metallic lustre. Its specific gravity is 4.9. It evolves an odor somewhat analogous to that of chlorine, and has an acrid, pungent, and burning taste. It stains the skin temporarily of a brown color, due to the formation of hydriodic acid. With starch it gives a characteristic deep-blue color, but when it is in combination with other bodies it must be set free before this test can be applied. At ordinary temperatures it evaporates slowly, and at 225° F., it melts and disengages a dense violet-colored vapor, which has a specific gravity of 8.7, and is the heaviest vapor known.

Iodine dissolves readily in alcohol, ether, and animal oils, forming a very dark brown solution, which gradually becomes paler on being exposed to the sunlight. Water precipitates it from its spirituous solutions, and in mixtures containing organic substances it is converted into ioduretted hydrogen.

TINCTURA IODINII.—*Tincture of Iodine.*

This is a solution prepared by dissolving a troyounce of iodine in a pint of alcohol. The tincture of iodine is very apt to become altered by exposure to the sunlight; and if not kept in well-stopped bottles, a portion of the alcohol evaporates, and iodine is precipitated. This result also takes place on the addition of water. It is employed almost exclusively as an external application, but may be given internally in doses of from *ten to thirty or forty drops*, very much diluted.

[1] Br. and For. Med. Rev., v. 163.

TINCTURA IODINII COMPOSITA.—*Compound Tincture of Iodine.*

This tincture is made by dissolving half a troyounce of iodine and a troyounce of iodide of potassium in a pint of alcohol. It is a more permanent preparation than the simple tincture, and has over the latter the great advantage that its iodine is not precipitated on the addition of water. Hence it is much better adapted for internal use. It is also much more readily absorbed, and therefore may be applied externally when it is desired to affect the system by this mode, or to influence local organic changes. It is much less irritating than the simple tincture.

The compound tincture of iodine may by administered internally in the dose of from *ten to thirty drops*, largely diluted with water or some mild liquid.

LIQUOR IODINII COMPOSITUS.—*Compound Solution of Iodine; Lugol's Solution.*

This preparation is made by dissolving three hundred and sixty grains of iodine and a troyounce and a half of iodide of potassium in a pint of distilled water. It is a stronger solution than the last, and differs from it also in having water for a menstruum instead of alcohol. Owing to this circumstance, it is less objectionable as an internal medicine. It is, however, used as an external application, and, when largely diluted with warm water, by inhalation also.

The dose of this solution is from *five to fifteen drops* in a draught of sweetened water, and repeated two or three times a day.

UNGUENTUM IODINII.—*Ointment of Iodine.*

This preparation is made by rubbing together twenty grains of iodine and four grains of iodide of potassium with six minims of water, and incorporating the mixture with a troyounce of lard.

UNGUENTUM IODINII COMPOSITUM.—*Compound Ointment of Iodine.*

This ointment is prepared by rubbing together fifteen grains of iodine and thirty grains of iodide of potassium with thirty minims of water, and incorporating the mixture with a troyounce of lard.

It is much preferable to the simple ointment of iodine, on account of the proportion of iodide of potassium which it contains, and which is more readily absorbed by the skin, while its local irritant effects are equal to those of the other preparation.

ACIDUM HYDRIODICUM DILUTUM.—*Diluted Hydriodic Acid.*

Hydrosulphuric acid gas is passed through water holding in suspension finely powdered iodine. The hydrogen and iodine combine to form hydriodic acid which remains in solution; the precipitated sulphur is separated by filtration; and the hydrosulphuric acid is driven off by heat. "By taking fixed proportions of iodine and water an acid of the desired strength is secured." In the officinal formula a troyounce of iodine is used to procure six fluidounces of the diluted acid. Each fluidrachm contains ten grains of iodine. *Dose, half a fluidrachm*, three times a day, largely diluted.

POTASSII IODIDUM.—*Iodide of Potassium.*

This salt is obtained by mixing together a hot aqueous solution of potassa and iodine slightly in excess. A part of the potassa is decomposed into oxygen and potassium, the former of which produces iodic acid with a portion of the iodine, which unites with the undecomposed potassa forming iodate of potassium. The remainder of the iodine combines directly with the metalloid, and forms iodide of potassium. The mixture is subsequently heated with charcoal, which abstracts the oxygen from the iodate of potassium, leaving iodide of potassium behind. By filtering and evaporating the solution, the latter product is obtained in a crystalline form.

Iodide of potassium generally crystallizes in cubes or octohedra. The crystals are sometimes transparent and sometimes opaque. They have a saline, penetrating, and bitter taste, readily deliquesce in a moist atmosphere, and are soluble in three-fourths of one part of cold water, and in six parts of alcohol. The solution is inodorous and colorless.

UNGUENTUM POTASSII IODIDI.—*Ointment of Iodide of Potassium.*

This ointment is made by dissolving sixty grains of iodide of potassium in half a fluidrachm of boiling hot water, and mixing the solution in a warm mortar with a troyounce of lard.

SULPHURIS IODIDUM.—*Iodide of Sulphur.*

By rubbing together four troyounces of iodine and one of sulphur, and heating the mixture to fusion, this compound is obtained. It is a solid of a grayish-black color, having the radiated appearance of sulphuret of antimony. It is soluble in about sixty parts of glycerin, but is insoluble in water. It stains the skin like iodine, and has the odor of this substance. It is chiefly employed as an external application, but may also be given internally in the dose of from *one to six grains*, and in pilular form.

UNGENTUM SULPHURIS IODIDI.—*Ointment of Iodide of Sulphur.*

Thirty grains of iodide of sulphur incorporated with a troyounce of lard form this ointment. Its qualities are those of a local stimulant.

ARSENICI IODIDUM. V. *Arsenicum.*

PLUMBI IODIDUM. V. *Plumbum.*

AMYLUM IODATUM.—*Iodized Starch.*

This preparation, which is not officinal, is formed by the admixture of one part of iodine and twenty of starch. It was proposed by Buchanan as a convenient means of introducing into the system a large quantity of iodine without irritating the alimentary canal. According to Winckler, when powdered starch is spread out under a bell-glass along with a vessel containing iodine, the starch absorbs so much iodine in the course of from one to two weeks as to turn almost black, and, on analysis, is found to contain as much as thirty-six grains of iodine to the ounce, while Buchanan's preparation contains only twenty-four grains to the ounce.

This mixture renders it possible to introduce a very large quantity of iodine into the system. Thus Buchanan prescribed as much as one ounce of it three times a day, which is equivalent to seventy-two grains of iodine, without any unpleasant symptoms.[1]

IODOFORMUM.—*Iodoform.*

This compound, which is a teriodide of formyl (C_2HI_3) is produced when iodine in the presence of an alkali or of an alkaline carbonate reacts with alcohol, gum, and various other substances. It may be obtained by adding chlorinated lime to a hot solution of iodide of potassium in alcohol. On cooling, this solution deposits iodoform and iodate of lime, the former of which is separated by solution in hot alcohol, which deposits it on cooling in the form of small yellow crystals, having a peculiar and unpleasant odor resembling somewhat that of saffron, and a sweetish taste. It is nearly insoluble in water, but dissolves in alcohol, ether, and chloroform, and in the volatile and fixed oils. Iodoform contains nine-tenths of its weight of iodine. It does not irritate the animal tissues. Dose, *one* to *three grains* in pill.

Medical History of Iodine.—The discovery of iodine in the mother waters of soda was made by Courtois in 1811, but its nature as an elementary body was determined by Davy and Gay Lussac in 1813. On account of the violet color of its vapor (ἰοειδής, *violaceus*), it received the name which it now bears. It was, as already mentioned, detected in a great number of natural bodies, and especially in *fuci* and sponges. These had long been celebrated for the cure of goitre. Even Galen speaks of burnt sponge as acrid and discutient, and other European and also Arabian writers say the same thing, but without any special reference to goitre. The productions referred to are, however, mentioned as curative of goitre in Chinese works of 1567.[2] In the thirteenth century, Arnold de Villanova, an eminent physician of Montpellier, employed burnt sponge for goitre and for scrofula, and in the beginning of the eighteenth century, Lemery spoke of it as a remedy for goitre and the scurvy.[3] In 1776, Mr. Lane, of London, reported two cases of this affection treated by the remedy in question.[4] Lewis says burnt sponge is a principal article in what was called the Coventry method of cure of the bronchocele, and also in that published by Mr. Prosser.[5] Indeed, it would appear that sponges and other marine products containing iodine, have from time immemorial been recognized as popular remedies for goitre and scrofula, and to these may be added cod-liver oil, which, in its natural state, contains a minute proportion of iodine.

In February, 1820, Dr. Straub, of Hofwyl, published an account of his having discovered iodine in sponges, etc., and suggested that

[1] London Med. Gaz., xviii. 516.
[2] STANISLAUS JULIEN, quoted by BOINET, Iodothérapie, p. 1.
[3] Dict. des Drogues, 2ème éd., p. 811.
[4] Mem. Med. Soc. Lond., i. 217.
[5] Mat. Med., 4th ed., 1791, ii. 385.

iodine might be advantageously used in all the diseases in which prepared or burnt sponge had been employed.[1] In the same year, Coindet, of Geneva, finding that *varech* (*fucus vesiculosus*) had been used as a remedy for goitre in the same way as burnt sponge, suspected that the iodine which both contain was the source of their curative properties. He accordingly put his conjecture to the test of experiment, and met with astonishing success, an account of which he published in July, 1820.[2] Immediately the new remedy became famous, and was employed not only for its original purpose, but for various and discordant objects, many of which it failed to accomplish. It was also used with so little circumspection as to occasion the serious results of acute and chronic poisoning; so that it began to be viewed with distrust, and was prescribed reluctantly. The gradual introduction of iodine into medical practice, through the influence of Coindet, Lugol, Biett, Gardiner, Lallemand, Velpeau, and, more recently, by Gibert and Boinet, has overcome the disfavor with which its preparations were viewed, and they now stand second in value to mercury alone among alterative medicines.

Action. *On Plants.*—According to Cantu, the seeds of plants sown in clean sand, and watered with a solution of iodine, germinate rather sooner, and produce somewhat hardier plants than usual.[3] Results, the very opposite of these, were obtained by Vogel, Robin, and Bouchardat, the last named of whom asserts that plants die, in the course of two or three days, in water containing one-thousandth part of iodine, and that a somewhat stronger solution of iodide of potassium is very injurious to them. These discrepancies are perhaps reconcilable by a reference to the quantity of iodine employed in the several experiments. In minute proportion, it probably promotes vegetation, for it exists in many of the most fertile soils.

On Animals.—According to Bouchardat, iodine is an active poison of the lower animals, for fish perish in from two to five minutes in a watery solution containing only the one-thousandth part of this substance.

When *small* and *often repeated* doses of iodine, or of its tincture, are given to animals, they produce general excitement of the nervous and arterial systems, irritation of the stomach and bowels, shown by vomiting and diarrhœa, an increased flow of urine, and a gradual but progressive emaciation of the whole body, but especially of the glandular structures. *Larger* doses occasion more decided evidences of gastro-intestinal derangement, and very large ones produce inflammation and ulceration of the stomach, generally terminating in death within a week.[4] Yet some animals recover in spite of excessive doses of iodine. Dick, of Edinburgh, gave iodine to a horse for three weeks, in doses of from one to sixteen drachms, or on an average, two drachms, without any other effect than to create a marked aversion to water.

[1] Med.-Chir. Trans , xi. 432.
[2] Bayle, Bibl. de Thérap., i. 1.
[3] Boinet, op. cit., p. 47.
[4] Strumpf, Handbuch, ii. 666.

As an illustration of the effects of iodine in large doses, the following experiment of Orfila may be quoted.[1] Ten drachms of iodine were given to a dog of medium size. It appeared to irritate the fauces, for the animal's mouth was presently filled with a yellowish foam, and repeated acts of swallowing were performed. Five hours afterwards, fæces of a natural consistence were voided, and yellowish matters were vomited. There was but slight evidence of pain. On the morrow, the dog refused food, and lay still; the third day, there was some fever, and in the evening a stool, which, however, contained no iodine. On the seventh day, the animal died from mere exhaustion, having presented no definite or characteristic symptoms. The stomach, on examination, was found lined with thick and tenacious mucus; seven or eight linear ulcers were formed upon folds of the mucous coat, and elsewhere, softening of this membrane was more or less marked. The lining membrane of the small intestine was covered with a yellowish and tenacious mucus tinged with blood. These lesions appear to have been due mainly to the direct corrosive action of the iodine.

Dr. Christison gave forty grains of finely-powdered iodine in an ounce of water to a rabbit, followed by an equal quantity of pure water. Very soon the pupils became dilated, the heart beat feebly and slowly, the breathing was laborious and jerking, and saliva flowed abundantly from the mouth. In half an hour the animal was dead. The only lesion found was a corrugated and roughened condition of the mucous membrane of the cardiac portion of the stomach, and fluidity of the blood in the large vessels.

When iodine in solution is injected into the *veins*, it is, in general, speedily fatal, occasioning convulsive movements, dyspnœa, cough, and tumultuous beating of the heart. But when Patu injected a drachm of iodine dissolved in two ounces of diluted alcohol, into the jugular vein of a horse, the animal at first manifested great disturbance of function, yet in the course of an hour and a half had quite recovered.[2]

Dévergie administered to a dog, through an opening in the œsophagus, two drachms of *iodide of potassium* dissolved in an ounce of distilled water. Efforts at vomiting ensued, the animal seemed prostrated, and died on the third day. Upon dissection, the gastric mucous membrane was found red, especially at the greater extremity of the organ, and numerous dark striæ ran in various directions. Some spots of ecchymosis existed in the submucous tissue.[3] In another experiment, three drachms of the salt were employed, and a ligature was applied to the œsophagus. After some indications of pain, the animal became quiet, and grew more and more dull, until, on the third day, it died in a state of complete relaxation. In addition to the lesions found in the first case, there were superficial ulcers of the mucous membrane. In other cases submucous emphysema was observed in the stomach. In the experiments of

[1] Toxicologie, i. 97.
[2] STRUMPF, op. cit., ii. 668.
[3] Archives Gén., x. 264.

Steubenrauch, of Berlin, who gave rabbits from two to eight drachms of iodide of potassium dissolved in water, the symptoms were slow respiration, general prostration, a feeble pulse, diuresis, spasms, and death in the space of from one to four hours.

When a solution of iodide of potassium is injected into the *veins* of an animal, death takes place very speedily, and is preceded by convulsions. Experiments upon larger as well as smaller animals, such as horses and rabbits, and performed by various persons, have furnished almost identical results. In most cases the blood is of a bright red color, and shows but little tendency to coagulate.

Upon Man.—Externally. On the Skin.—When iodine mixed with an unctuous substance is applied by friction to the skin, and especially if the integument is delicate, a sense of warmth is perceived, with more or less redness, prickling, and burning, which may indeed become very severe. The tincture of iodine stains the skin of a yellow or brownish-yellow color, which gradually disappears; but if the tincture be strong or the skin tender, an exfoliation of the cuticle usually takes place. Sometimes the application is followed by an erythematous inflammation which may extend beyond the part covered by the solution and occasion a burning pain and some fever. Sometimes, also, a measly or papular eruption appears, and, in either case, if the part affected is furnished with hairs, they are apt to fall out. The absorption of iodine, when it is applied to the skin, is supposed to be shown by its action upon glandular structures, causing them to diminish in size, and by the colic, diarrhœa, and dryness of the fauces which are reported to have been observed in some cases. It has, in fact, been generally believed that iodine produces its deleterious and also its curative effects upon the system, quite as certainly, though, perhaps, not so readily, by the external as by the internal mode of its administration.[1] Yet it was found by Braune that neither foot-baths containing forty-five grains of iodide of potassium in six quarts of water, nor frictions with iodine ointment upon the breast, abdomen, and back, produced the slightest trace of iodine in either the saliva or the urine.[2] Dr. Murray Thomson, also, could find no trace of iodine in the urine after spreading over both feet and legs as high as the middle of the tibia a moderately thick coating of iodine ointment, which (we infer, for it is not so stated) was allowed to remain all night covered with cotton socks.[3] On the other hand, Rosenthal found that after frictions with an ointment of pure iodide of potassium upon a large surface of sound skin iodine was detected in the saliva as well as in the urine;[4] Dr. Gillespie reports that a delicate boy, who had a saturated tincture of iodine applied to several swollen cervical glands, was seized with vomiting and purging, intense thirst, burning pain in the abdomen, suppression of urine, etc. He died at the end of thirty hours. The stomach and intestines were inflamed and ecchymosed, and a small quantity of urine in the bladder gave

[1] Med.-Chir. Rev., June, 1824, p. 105; also BUCHANAN's Remarks, loc. cit.
[2] VIRCHOW's Archiv, Marz, 1857, p. 295. [3] Edinb. Med. Journ., vii. 1024.
[4] Prager Vierteljahrs., lxxx. Anal., p. 6. Ibid. PHILIPPEAUX.

slight indications of the presence of iodine.[1] A woman very susceptible to the action of iodine wore a chemise which had been previously dipped in water containing two drachms of iodide of potassium and then dried. After three days this garment was replaced by a similar one, and on the following day the phenomena of iodism were fully developed.[2] Other illustrations are presented in the introduction to this work. If tincture of iodine is applied to the denuded cutis, as upon a blistered or ulcerated surface, it acts as a caustic, producing severe pain, and afterwards gastro-intestinal derangement. Bonnet has shown this to be true,[3] and similar results (which he employed therapeutically) were obtained by Philippeaux.[4]

On Mucous and Serous Membranes, etc.—When tincture of iodine is applied to the denuded cutis, or to mucous membranes, its action is nearly the same as upon the skin, viz.: it occasions smarting followed by contraction and dryness of the tissue, which is then protected from the air by a film of albumen mixed with iodine. If the application is frequently repeated, swelling, pain, and bloody exhalation may ensue. The contact of a solution of iodine with the living *serous* membrane produces inflammation of varying intensity, according to the preparation employed. Of a certain strength, it appears to limit its action to the arrest of the secretion proper to the membrane, but when more concentrated, it excites adhesive inflammation. The membrane afterwards presents a shining surface of a somewhat leaden color. The liquid is in part absorbed, and can be detected in the secretions. Owing, perhaps, to the facility of its absorption from cellular tissue as well as from serous membranes, it seldom occasions inflammation when by accident or design it is diffused through the former, and its action on the latter is mainly confined to limiting or preventing the tendency to serous effusion when that exists, unless it is applied in a concentrated form. It would appear from the following experiment that iodide of potassium is not readily absorbed by the bladder. Ségalas injected seven and a half grains of iodide of potassium dissolved in about two ounces of water into the bladders of ten healthy men. In no case was there any evidence in the saliva during forty-eight hours of an absorption of the drug. The same dose given per rectum was easily detected in the saliva and in the urine.[5]

Internally.—When strong *vapors* of iodine are inhaled, they irritate the mouth, fauces, and respiratory passages, occasioning coryza, cough, watering of the eyes, and headache. The prolonged action of iodic emanations, as in manufactures, gives rise to inflammation of the throat, severe pains in the breast, and sometimes to nervous disorder, such as confusion of the mind, dizziness, ringing in the ears, flashes of light before the eyes, and headache.[6] When pre-

[1] Times and Gaz., Nov. 1864, p. 488.
[2] Journ. of Cutaneous Med., ii. 317.
[3] Gaz. Méd. de Paris, and Am. Journ. of Med. Sci., Oct. 1852, p. 495.
[4] Bull. de Thérap., xliii. 19, 62.
[5] Edinb. Med. Journ., xv. 473.
[6] See a case related by TURNER, St. Bartholomew's Hosp. Rep., ii. 63.

parations of iodine are applied to mucous membranes or to the denuded cutis, they are readily absorded. Iodine taken internally has been detected in the blood, the milk of nursing women, in the tears, the saliva, and most of all in the urine. Wallace found it in the urine of a child whose nurse was taking iodide of potassium.[1] It has been detected within half an hour in the urine after the smoking of an iodized cigar. (*Strumpf.*) It has also been recognized in the serous effusion of hydrocele, and of dropsy of the joints, in persons who were taking it medicinally. But it has not been found in the perspiration, in the purulent secretion of the skin, or of mucous membranes, nor in the serum of blistered surfaces. Iodine is much less rapidly eliminated than the iodide of potassium. Indeed, it is maintained by some observers, in view of the large proportion of the latter excreted with the urine, that it is not decomposed in the system at all. The quantity discharged in this manner may be judged of from the experiments of Scharlau, who recovered three hundred and forty-five centigrammes of the salt from the urine of a patient who had taken three hundred and fifty centigrammes of it. The remaining five centigrammes must have been distributed to the other secretions, the saliva and the tears in particular. So Marchal gave the dose of one gramme (fifteen grs.) of the salt, and recovered nearly nine-tenths of it from the urine.[2] It is probable, however, that the rapidity of the elimination is not always the same. Thus, in a case in which *iodism*, produced by the iodide, was strongly marked, iodine was found in the urine six weeks after the medicine had ceased to be taken.[3] The experiments of Kammerer led him to the conclusion that the action of iodide of potassium is altogether identical with that of free iodine, and is due to the decomposition of the iodide in the blood;[4] but the facts above stated, taken in connection with this experimental and very probable conclusion, appear to show that the greater part of the iodide of potassium usually administered is literally wasted. On the other hand, it must not be overlooked that of late years very large doses of the medicine have proved curative especially of constitutional syphilis when small doses such as alone were formerly given were entirely ineffectual. The tendency of iodine to be excreted chiefly by the kidneys, is further illustrated by Buchanan's experiments with the iodide of starch. He analyzed the alvine dejections of a patient who was taking daily an ounce of this compound, containing thirty-six grains of iodine. They were natural in color, or even paler than usual, and did not contain a particle of iodine.[5] The same experimenter having taken two drachms of the iodide of potassium, drew blood from his arm as soon as the salt appeared in his urine, and found both serum and crassamentum deeply impregnated with iodine.

The carefully conducted experiments of Dr. C. Handfield Jones, undertaken for the purpose of discovering, if possible, some uniform

[1] Lancet, March, 1836, p. 6.
[2] Iodothérapie, p. 32.
[3] Revue Méd., civ. 570.
[4] Virchow's Archiv, lix. 467.
[5] Lond. Med. Gaz., xviii. 517.

effects upon the urine from iodide of potassium, could determine none. It increased the urine or diminished it, rendered it sometimes more and sometimes less acid, and had an equally variable influence upon its proportion of chlorine, of urea, and of uric, sulphuric, and phosphoric acids.[1]

The effects of iodine *in small doses, but not long continued*, may be inferred from the following experiments: Orfila took two grains of this substance, fasting. He found its taste extremely disagreeable, and was somewhat nauseated. The following day, on increasing the dose to four grains, a sense of heat and constriction in the throat was felt for a quarter of an hour, when vomiting of the iodine took place. The next day but one he took six grains of iodine, and, as before, immediately experienced heat and constriction of the throat, nausea, eructation, salivation, and epigastric pain. In ten minutes, copious bilious vomiting occurred. On the morrow, no effects of the medicine remained, except a slight feeling of lassitude.[2]

The experiments of Jörg and his assistants offer more detailed results. They used a tincture containing one grain of iodine in ten drops of alcohol. Of this preparation, from one to five drops in half an ounce of water caused an irritation of the throat with a saltish taste in the mouth, and more or less oppression in breathing. The larger of the doses occasioned fugitive pains in the head, back, and arms, augmented appetite, and copious frothy stools, followed by constipation. Doses of from six to fifteen drops gave rise, in addition, to colic and borborygmi, hunger, thirst, watery stools; an increased flow of light-colored urine, of nasal mucus, and of saliva; transient malaise, tension of the head, and oppression of the chest. When the dose was raised to eighteen drops the symptoms were more marked, and besides those already enumerated, there was a diffused sense of heat, quickened pulse, sexual excitement, and a dry cough.

The experiments of Jörg led him to the following conclusions: Iodine irritates the alimentary canal, augmenting the salivary and pancreatic secretions, increasing hunger and thirst, and producing colic and diarrhœa. It also occasions pains in different parts of the head, and tends to develop irritation, congestion, and even inflammation of the lungs, augmenting at the same time the secretion of the nasal passages and the bronchia. It further excites the genito-urinary organs when its action attains its maximum or has been long continued; but this effect is not constant.[3]

Among the symptoms produced by the *continued use* of iodine in medicinal doses the following call for especial notice. Various *eruptions of the skin* appear, of which the most common is acne indurata. A rare form is an eruption of bullæ filled with a clear, turbid, or bloody liquid. A case is recorded by Dr. Bumstead in which the medicine produced such an eruption upon a patient on several occasions of his using it.[4] A somewhat similar eruption

[1] BEALE's Archives, i. 182. [2] Toxicologie, 5ème éd., i. 100.
[3] Materialien, p. 473, etc. [4] Amer. Journ. of Med. Sci., July, 1871, p. 99.

produced by the same cause is figured by Hebra under the name of *Hydroa*. The *salivation* which it produces, independently of mercury in the system, is, in many cases, very analogous to that which is observed during pregnancy. It is usually mild, and ceases when the medicine is suspended. In particular the secretion is destitute of the fetor which is characteristic of mercurial salivation. Yet like this it is sometimes, although rarely, accompanied with inflammation of the palate and fauces, loosening of the teeth, and swelling of the salivary glands, but never with ulceration. The patients usually complain of a saline taste in the mouth. Iodic salivation cannot be very frequent, for many practitioners have used the medicine extensively without ever having witnessed it. In a hundred cases Lisfranc did not once observe it.[1] A case is mentioned by Buchanan of a man who in the course of twenty-four days took 2864 grains of iodide of potassium, when he became salivated and had swelling of the face with *ulceration of the mouth*. But the patient had several times before been salivated with mercury.[2] In a discussion of this subject at the College of Physicians of Philadelphia, a number of cases were referred to in which salivation had followed the use of iodide of potassium. In some of them mercury had previously been taken, but in others none.[3]

Increase of appetite with an improved condition of the general appearance, has repeatedly been noticed; indeed, the desire for food is sometimes craving. On the other hand, and particularly when the tinctures of iodine are administered, evidences of gastric irritation are pretty sure to arise sooner or later.

The influence of iodine upon the *mucous membranes* is marked by coryza and a congested state of the nostrils and pharynx, a feeling of tension over the frontal sinuses, and a red and œdematous state of the conjunctiva and eyelids. Langston Parker has described a swollen, lobulated, and fissured condition of the tongue produced by the long-continued use of preparations of iodine. The action upon the gastro-intestinal mucous membrane has already been referred to, but it may here be added that the mucous secretion of the bowels may be increased so as to render the stools slimy. There is also a mucous deposit from the urine, and this secretion becomes alkaline. Discharges from the urethra or vagina which have recently been cured are very prone to recur under the influence of this medicine. Perhaps it is owing to the congestion or irritation which appears to affect these parts, that the menstrual discharge is apt to increase in the female, and that in the male erections of the penis and seminal emissions are observed, signs of excitement which, in some cases at least, seem to be afterwards exchanged

[1] Two striking cases of iodic salivation are related by Drs. BATTERSBY and NELIGAN, *Dublin Quart. Journ.*, xxi. 412. WALLACE saw one in a child four years of age, *Lancet*, March, 1836, p. 8. Dr. M. GAUGHEY saw a woman, twenty-four years old, in whom a dose of ten grains of iodide of potassium "produced dry throat, loss of articulation, swelling of the neck, tremendous salivation, and delirium, which passed off in the course of four or five hours." Phila. Med. Times, i. 396.

[2] Lond. Med. Gaz., xvii. 522. [3] Trans. Col. Phys., Phila., April, 1855, p. 409.

for an opposite state denoted by atrophy of the testicles or mammæ and sexual indifference.

It is difficult to select from the above enumeration of phenomena those which are most distinctive and characteristic. If we are to accept the statements of certain writers, the medicine often acts as iron does, in appropriate cases, augmenting the appetite and strength, and the activity of all the functions, mental as well as bodily. Others, however, mention such effects as rare, or as only secondary to the removal of the disease which the medicine was given to cure; while others still attribute to a slight excess in using it a peculiarly distressing depression of mind and body, amounting even to hypochondriasis. Finally, not a few have been unable to notice any phenomena attributable directly to iodine. We can only infer from this diversity of effect, that the apparent operation of the medicine is greatly influenced by the condition of the patient to whom it is administered.

The number of cases which have terminated fatally through *the direct poisonous agency* of iodine is very small indeed. Almost the only one in which death occurred within a week from the ingestion of the poison is that reported by Mr. J. H. Smith, of Sheffield.[1] But in this example the patient, a woman, was laboring under erysipelas of the face. The quantity taken was rather less than a drachm of iodine in an ounce of spirit. In other cases the symptoms have been a burning heat of the throat and stomach, retching and sometimes vomiting, severe griping pains, diarrhœa, general paleness, cold extremities and collapse, followed, in some instances, by redness of the skin, an active pulse, and other signs of reaction. Even such cases usually terminate favorably, or, if fatal, become so by exhaustion after the lapse of several weeks. In one reported by Nélaton symptoms such as have been described followed the injection of a diluted tincture of iodine into the cavity of an abscess of the thigh. A female patient of the same surgeon became affected with œdema of the glottis during the use of iodide of potassium.[2] A similar, but fatal, case of the same accident occurred in the practice of Dr. Lawrie.

This preparation, even in moderate doses, has occasionally produced alarming symptoms. In one case reported by Dr. Lawrie the larynx was also the part affected, and the symptoms resembled those of spasmodic croup. There had been taken in all but seven and a half grains of the salt. In another case, where half a drachm had been administered in the course of four days, the patient complained of excruciating headache, and acute pain in the eyes, with profuse lachrymation.[3] Dr. Horst relates the history of a man, who, after taking less than a grain of the iodide of potassium, complained of fulness of the head, giddiness, constriction of the throat and chest, dryness of the mouth, anxiety, tickling cough, and trembling of the limbs in walking. These symptoms lasted an hour. The evening of the same day they returned on a second

[1] TAYLOR on Poisons (1st Am. ed.), p. 249.
[2] Abeille Méd., x. 317.
[3] London Med. Gaz., xxvi. 588.

dose being taken, and on subsequent days, also, they recurred when the medicine was repeated.[1] In the last case we suspect that the solution contained the *cyanide* rather than the *iodide* of potassium; and in the previous ones, it must be presumed that the medicine was not what it was supposed to be, or else that its effects were quite exceptional.

Uncertain Effects of Large Doses.—Very large quantities of iodine have sometimes been taken without injury, a fact which can only be explained on the supposition that the medicine combined immediately with the starchy or albuminous contents of the stomach. Magendie states that he took two drachms of the tincture, containing ten grains of iodine, without injury, and that a child, four years old, swallowed the same quantity without serious consequences.[2] Dr. Samuel Wright met with the case of an infant not more than three years old, who took three drachms of the tincture at once, and suffered only from attempts to cough, some retching, and much thirst.[3] In like manner we are told by Gully that he used the tincture, in gradually increasing doses, to the extent of three drachms a day, without observing any ill effects from it. Kennedy is quoted as having given nine hundred and fifty-three grains of iodine in the form of tincture, in the course of eighty days, to a woman, and at the end of this period, eighteen grains a day, without her general health being at all impaired.[4] Buchanan states that among his patients in the Glasgow Infirmary, many took a quarter to half a pound of iodine in the course of a month or six weeks, and others of them half an ounce in the space of twelve hours, without its producing any injurious effects upon the general health.[5] The only precaution he observed in giving these large doses, was to make the patients drink freely of diluents. Delisser gave a scrofulous child, three years of age, two hundred and twenty-two grains of iodine in less than two months; and to a lady affected with cancer of the breast, one thousand one hundred and nineteen grains in two months. At one period "her mouth fell into a sort of ulceration, with fetid breath, differing, however, from that caused by mercury, and, if possible, more disagreeable," but ten days' suspension of the medicine sufficed to remove these symptoms.[6] Julia de Fontenelle relates the extraordinary instance of a young man who swallowed, by mistake, a solution containing more than two and a half drachms of iodine, and yet did not experience any remarkable effects.[7] Dr. Porcher speaks of a case in which sixty grains a day of iodide of potassium were given for ten days without the slightest injurious consequence, or any appreciable effect, except relief of the nocturnal pains of tertiary syphilis. In another case the patient took forty grains daily for twenty days,

[1] DIERBACH, Neueste Entdeck., iii. 980, where other cases will be found of unusual symptoms from apparently small doses of iodide of potassium.
[2] GALTIER, Toxicologie, i. 100.
[3] CHRISTISON, On Poisons (Am. ed.), p. 155.
[4] Lond. Med. Repository, 1822. [5] Lond. Med. Gaz., xviii. 515.
[6] Edinb. Med. and Surg. Journ., xi. 230.
[7] STRUMPF, op. cit., from Journ. de Chimie, 2ème sér., i. 545.

without untoward effects except a feeling of fulness about the head, and symptoms of catarrh.[1] Of the iodide of starch still larger doses, as an ounce three times a day containing seventy-two grains of iodine, have been given without any untoward results.

Chronic Poisoning. *Iodism.*—The general derangement of health which is sometimes the consequence of taking large doses of iodine for a long time, was early described by Coindet, who noted among its phenomena the following: a frequent pulse, palpitation of the heart, dry cough, sleeplessness, rapid emaciation and loss of strength, swelling of the legs, trembling of the limbs, nervousness of the movements, etc. Subsequent experience enables us to enlarge this catalogue considerably, which, however, is only to a small extent, and in rare cases, descriptive of the effects of iodide of potassium.[2]

Iodism is most conspicuously manifested by the *alimentary canal.* Digestion is impaired, and the appetite lost; the patient complains of an annoying and even a painful sensation in the throat and epigastrium, which ultimately becomes a fixed burning pain in the latter, and a distressing heat and dryness of the former. Watery diarrhœa ensues, with colic, and sometimes salivation,[3] which in certain cases may be attributable to the revival of mercury in the system, conjunctivitis, coryza, nasal catarrh, and emaciation. The opinion has been entertained, that iodine produces emaciation by its stimulation of the absorbent system. Hence the loss of flesh usually proceeds faster in children than in adults. Graefe, of Berlin, employed iodine as "an emaciating agent," with complete success, in a case of polysarcia.[4] Cullerier has pointed out a probable explanation of the different results of observation in respect to this subject. He remarks that if the patient is in poor condition through the influence of a disease which iodine is capable of curing, he will increase in flesh with the progress of the cure. This writer cites from his own experience several cases which illustrate the tendency of iodine to produce atrophy of the testicles and the mammæ, and to diminish the mammary secretion.[5] Other symptoms, referable to the *nervous system*, are produced by iodine; such as anxiety, palpitation of the heart, sleeplessness, painful dreams, headache, disordered vision and hearing, dulness of mind, and general debility.[6] Occasionally there is tremulousness of the hands and of the arms and legs, and even convulsive attacks have been observed. Sir B. Brodie asserts that he has known iodine to cause paralysis. The following case illustrates in a striking manner this class of symptoms. The patient, a man of fifty-five years, was under treatment with iodide of potassium for an eruption of *acne indurata.* At first he experienced a painful burning sensation in the feet, then a trembling of the limbs and a feeling like intoxication. His movements were irregular and uncertain, and his expression haggard and dull; he became short-sighted, and objects often appeared double or in

[1] Charleston Med. Journ., xi. 174. [2] BUCHANAN, Lond. Med. Gaz., loc. cit.
[3] OESTERLEN, Heilmittelehre, 4te Aufl., p. 278.
[4] HOBSON, Trans. New York Med. Soc., ii. 299, and Brit. and For. Med. Rev., v. 164.
[5] Revue Méd. cii. 603, etc. [6] DIERBACH, Neueste Entdeck., iii. 975.

rotary motion. By degrees the muscles of the lips and cheeks became paralyzed, the gait staggering, and the articulation spasmodic, or jerking.[1] In some cases preparations of iodine affect *the skin* and even the *hair*, rendering the color darker. More commonly there is a tendency to copious perspiration and to eruptions of urticaria, impetigo, prurigo, lichen, eczema, or furuncles. In some cases also ecchymosis or purpura of the inferior extremities has been observed. Dr. Sydney Ringer has published the case of a lad in whom a petechial rash was produced both by the iodide of potassium and the iodide of ammonium, but not by the iodide of sodium.[2] Anæsthesia of the skin from the local application of tincture of iodine has been noticed. In other cases the *genital organs* are affected. The sexual propensity is sometimes unduly excited,[3] the menstrual flow excessive, and during pregnancy abortion may take place in consequence of the direct operation of the medicine, or as an effect of the retarded development of the fœtus. The discharge of urine is generally increased, and is often darker than natural, or at any rate, becomes so readily on the addition of nitric acid and starch.

At the risk of some repetition, we think it of interest to direct attention to those constitutional effects, even of very small but long continued doses of iodine, which were first systematically described by Rilliet, of Geneva, and which demonstrate a special susceptibility to the operation of the medicine.[4] These effects have occasionally been observed even during a sea-side residence from the iodic exhalations of the salt water, and still oftener as the consequence of using mineral waters containing a minute proportion of iodine. But at Geneva, it appears that they are met with much more frequently than elsewhere, a fact which denotes an extreme and exceptional susceptibility to the action of iodine, and which is attributed by Rilliet to the absence of iodine from the air and the water of that locality. Consequently the inhabitants are more intolerant of its action than those of other places who constantly respire it, and imbibe it with every draught of water. It follows that persons affected with endemic goitre are more susceptible to the action of iodine than those who live in places where the disease does not prevail. This peculiarity had been remarked before the reason of it was discovered in the absence of iodine from the air and water. The morbid susceptibility in question has rarely been observed in the earlier periods of life, but increases with the years after the age of thirty, and affects those only whose health was previously unimpaired. Its most striking symptoms are rapid emaciation, while the appetite not only continues good, but is rather unnaturally craving, and nervous palpitations of the heart, with a whole train of phenomena, including debility, depression of spirits, and sleepnessness, which justly excite the apprehensions of the patient. In the most aggravated form of iodism the goitre, if there is one, diminishes rapidly, and may even in a few days dis-

[1] Revue Méd., civ. 568. [2] Practitioner, viii. 129.
[3] See a case by ZINK, Journ. Complémentaire, xviii. 126.
[4] Bull. de l'Acad., xxv. 382.

appear; emaciation reaches its extreme limits, but affects the glands above all, and particularly the mammæ and testicles; the pulse becomes small and quick, and the complexion yellowish or greenish; the eyes are sunken and leaden, and the expression dull and anxious. The slightest exercise occasions panting respiration and causes exhaustion, the mental state is one of constant apprehension, and the sleep is broken by frightful dreams. In spite of the alarming character of its symptoms the disease rarely proves fatal, and the most ordinary permanent traces of its existence are seen in the atrophic condition of the mammary and seminal glands. It is also important to note that with the restoration to health the goitre also returns.

Action of Iodoform.—The large proportion of iodine in this compound has led to its being ranked among the preparations of iodine; but a brief description of its action will throw doubts upon the propriety of this arrangement. Given to dogs in the dose of from ten to fifteen grains it occasions a sort of intoxication followed by depression. The animal lies still, and if he is aroused staggers in walking and then falls upon the side. After a few hours no traces of these effects remain. If the dose amounts to fifty or sixty grains, prostration and intoxication are succeeded by rapid pulse, with spasms of the limbs, and opisthotonos, which occur in paroxysms ending in death. The breath smells strongly of the medicine. When a suppository of iodoform is introduced into the rectum, the bowel becomes insensible and the passage of its contents in defecation is not perceived. These various phenomena appear to show that iodoform, by its primary action at least, should be ranked with the anæsthetics. They give no indication of the large proportion of iodine that it contains, and its therapeutical applications have a like significance.

Remedial Employment. *Internally.*—Although for the sake of convenience, we shall consider at the same time the uses of iodine in solution, and of its several preparations, it cannot be denied that in many cases one of these may have a decided advantage over another. It has been seen that iodide of potassium is very rapidly eliminated from the system, very much more so than iodine itself; wherefore it is probable that the latter is to be preferred whenever it is intended to modify the living and normal elements of the economy, but that the former should be employed whenever the elimination of some effete, imperfectly organized, or abnormal material is the object to be accomplished. The relative value of solution of iodine and of the iodide of potassium has not been fully ascertained. The facility with which the latter is supported, and the completeness with which it performs some of its remedial offices, have perhaps led prematurely to the neglect of the less agreeable preparation, and it may be well for those who employ them to bear in mind that one may succeed where the other has failed.

Intermittent Fever.—Dr. V. Willibrand[1] from considerable and intelligent experience concluded that in iodine we possess a specific

[1] VIRCHOW's Arch., xlvii. 243.

remedy for malarial diseases equal to cinchona, and in one respect superior to the latter, since relapses are not nearly so apt to occur in the cures which it produces. Dr. V. W. used a solution of six grains of iodine and twelve grains of iodide of potassium in a drachm of distilled water, of which five drops were given in a wineglassful of water every two hours. In a case of recurring intermittent fever which at the time assumed a quotidian type, and which had mainly been treated with large doses of quinia, Dr. S. L. Abbot[1] prescribed five grains of iodide of potassium to be taken before each meal. After two days the paroxysms ceased and the general health was rapidly restored. Among the many substitutes for cinchona we do not remember to have learned before that iodine had been tried. Besides the clinical evidence just given in its favor its operation appears to harmonize with the most probable theoretical view of the nature of malarial diseases, viz., that they directly result from the operation of a morbid poison.

Mercurial Salivation.—In 1832, Knod. v. Helmenstreit, of Aschaffenberg, in several cases, successfully made use of the tincture of iodine internally, to combat mercurial ulceration of the mouth. In the following year this method was employed by Kluge, of Berlin, who effected a cure, in seventeen cases, in the course of from three to twelve days.[2] Many other physicians were equally successful, and among them Dr. Jaurin, of the Canary Isles,[3] and Aran, of Paris.[4] It is to be remarked that iodide of potassium has not always been found to possess the same virtue which is here ascribed to iodine. Dr. Laycock assures us that, given in ptyalism, it seems to have the effect of increasing the discharge;[5] and Hacker, of Leipsic, relates four cases in which a solution resembling Lugol's rather aggravated mercurial ulceration of the mouth. But this untoward result was probably exceptional. Dr. Corson, of New York, has published several cases which prove the iodide to have been in his hands a prompt and certain cure for mercurial ptyalism.[6]

Elimination of Mercury and Lead.—The earliest suggestion of the power of iodide of potassium to cure chronic poisoning by lead or mercury was made by MM. Guillot and Melsens to the French Academy of Sciences in 1844.[7] The more complete results of the latter were published in 1849.[8] In them, says the translator, Dr. Budd, it is assumed, no doubt rightly, that the metallic substance is in actual union with the affected parts, and is there retained as an insoluble compound. The iodide of potassium sets it free by rendering it soluble, and thus enables it to escape from the system, by the kidneys especially. That the saline solution liberates the metal lying dormant in the tissues, appears to be proved conclusively by

[1] Boston Med. and Surg. Journ., Oct. 1869, p. 166.
[2] DIERBACH, Neueste Entdeck., i. 430, and ii. 1010.
[3] Bull. de Thérap., xli. 234. [4] Ibid., xliv. 268.
[5] Lond. Med. Gaz., 1839, xxiii. 823.
[6] New York Journ. of Med., Sept. 1853, p. 243.
[7] Archives Gén., 4ème sér., iv. 517.
[8] Annales de Chimie, Juin, 1849; Brit. and For. Med.-Chir. Rev., Jan. 18[illegible], p. 201.

the fact that, on the administration of the former, symptoms arise which are peculiar to the metal with which the system is impregnated, and this is shown by experiments upon animals as well as by the observation of what takes place in man. Melsens showed that when an insoluble preparation of lead is given to a dog, comparatively slight symptoms ensue; but if the iodide of potassium be then administered, the animal will die. He also proved, by appropriate tests, that mercury thus set free is found in the urine; and similar proof, in the case of lead, was brought forward by Dr. Parkes,[1] of London, by Dr. Goolden,[2] and by Dr. Swift, of New York.[3] The last-named gentleman published an account of twenty-three cases of lead-poisoning which were treated very successfully by means of the iodide of potassium. In many of them lead could be detected in the urine during the administration of the remedy. These results were confirmed by M. Malherbe, of Nantes,[4] who detected the metal in the saliva as well as in the urine, and also by Dr. Sieveking.[5]

It follows from what has been stated above, that if the symptoms of poisoning by these metals depend upon their presence in the economy, a cure may be expected from their elimination. In the case of lead, abundant proofs exist of the efficacy of iodide of potassium in curing the various forms of nervous disease to which that metal gives rise. Dr. Nicholson reports one case in which lead colic was associated with paralysis, but both affections were cured by the iodide.[6] Melsens relates several in which paralysis and neuralgic pains had reached a serious degree, but were entirely cured by this medicine; and, as already stated, Dr. Swift has added largely to the number of those which prove the success of this treatment. The former gentleman dwells upon the necessity of caution in administering the remedy. If too freely exhibited at first, it is apt to produce the symptoms of acute saturnine poisoning. During the first period of the treatment, indeed for the first week or two, the urine is of a deep-brown color, but it gradually becomes lighter. The same remarks are applicable to the affections of the nervous system produced by exposure to mercurial vapors. The following case may serve as an example. An old man, who had been a gilder, lost the use of his limbs by the exercise of his calling. His sight was gone, and he was, moreover, tormented by violent and constant pains. Iodide of potassium was administered every day, in the dose of a drachm. At the end of a fortnight's treatment he left the infirmary alone and without help, whereas on his admission he was obliged to be brought on a litter. Equally striking cures were effected by M. Melsens when trembling palsy was added to the other symptoms mentioned. In fact, no medicine

[1] Brit. and For. Med.-Chir. Rev., April, 1853, p. 522.
[2] Lancet, Nov. 1853, p. 522.
[3] N. Y. Med. Times, iii. 145.
[4] Month. Journ. of Med. Sci., April, 1855, p. 342.
[5] Times and Gaz., Feb. 1857, p. 162.
[6] Lancet, Jan. 1854, p. 42.

appears to be more serviceable than iodide of potassium in all the forms of chronic poisoning by mercury and lead.[1]

Constitutional Syphilis.—The original suggestion for the cure of this affection by means of iodine, must be attributed to Dr. Robert Williams, of London, who, in 1831, employed it successfully in the treatment of various forms of syphilis, but, first of all, of two cases of nodes which had proved intractable to other medicines.[2] Dr. Clendenning soon afterwards published a number of cases illustrating its value in the affection referred to.[3] But more general attention was attracted to the subject by Dr. Wallace, of Dublin, whose large experience left no doubt in regard to the efficacy of the medicine.[4] Finally, its peculiar power of curing deep-seated syphilitic diseases of the integuments, cellular tissue and bones, was established in the confidence of the medical profession by M. Ricord.[5] Mercury is incompetent to cure the tertiary symptoms of syphilis, and, indeed, so often aggravates them, that they have been regarded by some persons as effects of chronic mercurial rather than syphilitic poisoning. However this may be, such symptoms are curable by the iodide of potassium more frequently, and with more certainty, than by any other remedy. It is also useful in the transition from the second to the third stage of syphilis, particularly when the system is impaired, and phagedenic or gangrenous ulcers attack the throat, and ecthyma or rupia appears upon the skin. When given to cure the appropriate symptoms, says Ricord, a marked and decided improvement rarely fails to appear during the second week of the treatment, and sometimes sooner. The tubercles are absorbed, the ulcers become clean, the suppuration diminishes, the osteocopic pains cease, and the osseous tumors, if they are not permanently indurated, soon begin to take on resolution. The success of the treatment of tertiary syphilis sometimes depends entirely upon the dose in which the iodide of potassium is administered. Cases which have only become worse or remained stationary under the usual dose of five grains three or four time a day, will often manifest a decisive progress towards cure when ten, twenty, or even thirty grains of the salt are administered at the same intervals. Several striking illustrations of this statement have been published by Mr. McGregor.[6]

At the London Ophthalmic Hospital this remedy is said to have been used with as much success as mercury in the cure of *syphilitic iritis;* but the reporter does not state whether or not the patients who were cured had or had not previously taken mercurials.[7] A subsequent report from the same institution renders it probable that the medicine is most successful when mercury has previously been taken, although it is often of itself sufficient for the cure.[8] It

[1] For more recent cases, *vid.* Times and Gaz., June 1869, p. 779; British Med. Journ., April 1871, p. 362.
[2] Lond. Med. Gaz., xiv. 41.
[3] Ibid., xv. 833 and 866.
[4] Lancet, Feb. 1836, p. 743, and March, 1836, p. 5.
[5] Bull. de Therap. (1839), xvii. 21.
[6] Edinb. Med. Journ., xv. 309.
[7] Times and Gaz., July, 1854, p. 11.
[8] Ibid., May, 1859, p. 546.

should be borne in mind that various affections not strictly belonging to the category of constitutional syphilis, may, nevertheless, derive their gravity and peculiar type from the syphilitic affection. Such are rapidly curable by the iodide of potassium. The most important are paralytic disorders; others affect the lungs.

The *modus operandi* of iodide of potassium in curing constitutional syphilis presents an extremely interesting problem. Although the question cannot be considered as thoroughly solved, cases like the following have been thought to render it highly probable that the medicine is chiefly curative by virtue of its power of liberating the mercury which an antecedent mercurial treatment had accumulated in the system. This explanation was originally proposed by MM. Melsens and Guillot, and, as already stated, was founded upon their experiments and observations previous to 1844.[1] Several years afterwards, the former of these gentlemen published an essay,[2] in which, by a variety of proofs, he showed that iodide of potassium is capable of rendering soluble every mercurial compound that can exist in the living economy, and even metallic mercury itself, and of causing their elimination with the urine, in which secretion they can be discovered by means of appropriate tests. But in order thus to eliminate mercurial preparations, it must first render them soluble, and consequently it may reproduce all of their specific operations, including both their curative and their morbid effects. Dr. Budd[3] refers to a case of secondary syphilis in a man who five months before had taken mercury largely, but subsequently had used none. On being treated with iodide of potassium, he was profusely salivated, and presented all the usual symptoms of this condition, including the characteristic fetor of the breath. Dr. Budd subsequently met with numerous instances of the same description. Dr. Garrod relates a case of constitutional syphilis in which iodide of potassium was administered without effect, until small doses of calomel were given, when full salivation ensued, and the patient became nearly well. Some time afterwards iodide of potassium was ordered anew, when within forty-eight hours mercurialization returned with such intensity that the salt had to be discontinued. Still later, however, the iodide was taken without any such effects, all of the mercury having probably been eliminated from the body.[4] Melsens has shown that iodide of potassium, administered along with a salt of mercury, renders the latter much more active, and that "the action of iodide of potassium, on a dog treated by corrosive sublimate, may be so energetic, that even eight days after he has taken the sublimate, a pretty large dose of iodide of potassium will prove fatal to him."

It has been maintained by Bouchardat[5] and others that the tertiary symptoms of syphilis are, in fact, owing to a mercurial rather

[1] BOUCHARDAT, Annuaire de Thérap., 1845, p. 168.
[2] Annales de Chimie, Juin, 1849; Brit. and For. Med.-Chir. Rev., Jan. 1853, p. 201.
[3] Brit. and For. Med.-Chir. Rev., Jan. 1853, p. 202.
[4] Times and Gaz., March, 1864, p. 248. [5] Annuaire, etc., 1850, p. 282.

than a syphilitic infection or poisoning, or, at all events, that they proceed from a combination of the two, and that the iodide is useful in curing these symptoms, not because it restores activity to the mercury, but because it expels the mercury from the system. If, in doing so, mercurial salivation occurs, it is, according to this view, an accident of the treatment, but is no wise necessary to its success. This theory is sustained by adverting to the singular rapidity with which the disease declines; and the doctrine that the cure is owing directly to the iodic preparation, is opposed by the fact that other forms of iodine have not the same beneficial effect.

But that iodide of potassium performs so negative and indirect a part in the cure of syphilis is not rendered probable by a survey of all the facts of the case. As Dr. Basham has very correctly pointed out,[1] there are two classes of cases presenting pains, nodes, etc., of the superficial bones, classes apparently identical in nature, yet differing in this, that the one is benefited by iodide of potassium, while the other is not so, but is relieved by mercury. Cases of the former class have at some previous time been treated by mercurials, while in the latter these remedies have never been used. The same writer, speaking of simple chronic rheumatism, states that no benefit is derived from iodide of potassium, unless mercury has previously been administered. Besides these and many analogous conclusions of clinical experience, we find, as in the results obtained by M. Melsens, that direct experiment favors the belief that iodide of potassium is useful in tertiary syphilis chiefly by reviving the mercury lying dormant in the tissues. It appears to be highly probable, also, that its salutary influence is derived in part, at least, from the state of minute division in which the mercury exists, and the increased facility it thence derives for penetrating the ultimate elements of the tissues.

Yet it must not be supposed that iodide of potassium is altogether incompetent to cure tertiary syphilis without the intervention of mercury. Ricord has emphatically pronounced this notion a mistaken one,[2] although he believes that a previous mercurial course is best fitted to secure the favorable action of the salt. It has also been proved erroneous by Dr. Hassing, of Stockholm. He treated with iodide of potassium 125 cases of tertiary syphilis in patients who had previously taken mercury, and 70 cases in those who had not done so.[3] Among the former cases, 29 resisted the treatment, and of the latter 21; so that although the proportion of cures was greater in the first class, yet it did not greatly exceed that obtained in the second. M. Rodet, of Lyons, it may also be remarked, maintains that iodide of potassium is most efficacious when no other treatment has preceded it. He even affirms that a previous mercurial course is often indirectly productive of unpleasant symptoms (iodism), and that iodic preparations sometimes occasion

[1] Lancet, Nov. 1853, pp. 478 and 500. [2] Lectures, 1849, Am. ed., p. 276.
[3] Brit. and For. Med.-Chir. Rev., Oct. 1845, p. 384.

formidable lesions when mercury has been taken shortly before.[1] This experience is certainly singular, unless it be taken as an imperfect representation of the effects observed by Budd and Melsens, and as attributable to the revival of the mercury by the iodine. These discordant views may perhaps be harmonized by that of Lancereaux which appears to explain the mode of action both of mercury and of iodine in syphilis: "These agents do not modify in any way the derangement of nutrition which presides over the formation of the syphilitic product, *since they are incapable of preventing their appearance.* Their action is exerted solely upon that product, or rather upon the elements which constitute it; it consists, in fact, in favoring the retrograde or fatty metamorphosis of those elements and their absorption. . . . Mercury and iodide of potassium do not attack the essence of syphilis itself but its manifestations. As in all diseases, the syphilitic diathesis is not cured by the efforts of therapeutics, but by the forces of the organism alone."[2]

Hypertrophied Organs.—The influence of iodine upon the function of nutrition is strikingly illustrated by its efficacy in the cure of hypertrophy, and the removal of unorganized deposits. Indeed, as is well known, the virtues of iodine were earliest recognized in one of this class of affections, viz., in goitre. In many cases of simple *chronic enlargement of glandular organs, e. g.*, of the mamma, the testes, the liver, the spleen, and the prostate gland, iodine appears to have exerted a very salutary influence, whether employed internally or topically. It may be presumed that its operation is most manifest in proportion as the increased size of an organ depends upon nutritive rather than inflammatory action, although it sometimes acts in the latter case with very happy effects. It has been used to diminish the size of the *mamma* when hypertrophied. It has also been proposed as a means of diminishing the size of the fœtus in utero in cases of contracted pelvis. Excessive corpulence has been reduced by its operation.

In *goitre* its virtues are most signally displayed. But, as Rampold and others have pointed out, there are two forms of disease confounded under the name of goitre, the one in which the tumor is formed of cysts containing a liquid, while the other is simply a hypertrophy of the gland with its cellular tissue and fat. The latter variety is readily cured by iodine, but the former is not so.[3] The one tumor is generally soft and painless, and is most curable when recently developed; the other is formed in part by calcareous or cartilaginous deposits. These statements will serve to explain the different degress of success obtained with iodine by persons who were not aware that tumors of the thyroid body are not always of the same nature. Thus Bardsley found that in some cases large tumors of this body greatly diminished within a short space of time under the internal and external use of iodine, but in not a few in-

[1] Revue Méd., ciii. 459. [2] Treatise on Syphilis (Sydenham Soc. ed.), ii. 334.
[3] CANSTATT, Jahresbericht, 1845, p. 226.

stances the beneficial influence of the remedy was solicited in vain.[1] Gairdner, on the other hand, states that the medicine seldom fails of effecting a complete cure, and, when it does so, it almost always reduces the swelling very considerably. Besides these radical differences in the tumors referred to, it should be borne in mind, as Coindet originally pointed out, that even in genuine bronchocele, if the part is tender and inflamed, or excites paroxysms of dyspnœa, it should first be leeched and fomented before a resort is had to iodine.[2] It is probable that all cases of true goitre in persons under middle life are curable by iodine. Bayle, in his summary of results, which evidently includes a great many cases unsuitable for this treatment, found that 264 out of 364 cases were cured. In favorable cases the action of the medicine is apparent within a few days, the tumor becoming softer and smaller, and its interference with breathing and swallowing much less. Not unfrequently the cure is effected in from six to eight weeks. It sometimes happens that the rapid subsidence of the goitre is attended with general emaciation, which is, however, temporary. It is advisable to administer the compound solution of iodine internally in the dose of from five to ten drops three times a day largely diluted with water.

The addition of a syrup containing tannic acid, as the syrup of cinchona, or of orange-peel, is said to prevent the medicine from deranging the stomach. At the same time, iodine ointment should be applied externally, or a mixture of equal parts of tincture of iodine and sulphuric ether, or else, as Boinet recommends, an iodized collar should be worn, composed of finely powdered iodine quilted between two layers of cotton wadding, covered on either side with several folds of flannel, and externally by a layer of oiled silk, or of gutta percha, to prevent evaporation.

Dr. Glover has used *iodoform* very successfully in several cases of goitre, one of them of seven, and another of four years' standing. He gave the medicine in doses of two or three grains, three times a day.[3] Guéneau de Mussy has reported several cases of large goitre in which iodized starch produced a rapid and complete cure without at all disordering the digestive functions.[4]

Scrofula.—From the use of iodine in the cure of goitre, to its employment in other *glandular enlargements* and to *scrofula*, the transition was easy. But since the time when Lugol held iodine to be a specific for scrofula, as really as cinchona is for ague, or mercury for syphilis, experience has shown his estimate to be an exaggerated one. Some have even gone so far as to attribute all of the improvement which notoriously took place in many of his patients at the St. Louis Hospital, to the good food and the comfortable lodgings which many of them then enjoyed for the first time in their lives. Certain it is that in private practice a similar degree of success has seldom been obtained.

[1] Hosp. Facts and Obs., p. 122. [2] Bibliothèque de Thérap., i. 22.
[3] Month. Journ. of Med. Sci., Feb. 1848, p. 581.
[4] Bull. et Mém., Soc. de Thér., i. xlii.

In the most common and the earliest form of scrofula, glandular enlargement, two elements are frequently combined, the hypertrophic and the tubercular. Under the influence of iodine, especially in the form of lotion or liniment, the former may be entirely removed, but it is doubtful whether the latter is ever really so. At an advanced stage of the disease, when softening of enlarged glands and ulceration of the integuments have taken place, iodine will frequently promote the healing of the ulcers, while it improves the general health in a marked degree. Even in scrofulous enlargements of the articulations depending partly upon thickening of the fibrous coverings and partly upon effusion within the synovial capsule, this medicine, externally as well as internally, exerts a decidedly curative influence, especially when associated with cod-liver oil. It is also capable of producing a marked amelioration of caries of the bones, and sometimes it effects a complete and permanent cure. It is prudent in all such cases not to make use of iodine, so long as an inflammatory action predominates; if then employed, it tends to induce suppuration of the enlarged glands, and to excite inflammation in other diseased structures. It is true that the suppuration is generally of a more acute form, and terminates more rapidly in cure than that which tends to arise spontaneously, and probably would so arise in the part affected. *Tabes mesenterica*, although generally a fatal disease, is probably in some cases susceptible of cure. This would appear to be proven by Rilliet and Barthez, who found the mesenteric glands converted into cretaceous masses. A number of cases, also, collected by Boinet seem to show that the removal of the disease occasionally takes place under a plan of treatment of which iodine forms the principal part. But in this, as in all other scrofulous affections, the association of iron and cod-liver oil with iodine greatly enhances the probability of cure. To be successful, also, the treatment must be continued for a long time after the disappearance of the local disease. For scrofula is eminently a constitutional affection, and it is only by a well devised and steadily pursued regimen, both dietetic and medicinal, that it can be kept in abeyance. It is in this disease that Boinet especially recommends his iodized food, consisting of bread, gingerbread, cakes, biscuits, chocolate, wine, beer, etc., made with natural products yielding iodine, such as fuci, marine plants, cruciferæ, salts containing iodine, and some mineral waters holding this substance in solution.[1]

Scirrhus and Cancer.—The great difficulty of distinguishing the true character of all hard tumors affecting the glandular structures has led to very opposite estimates of the different remedies which are alleged to cure cancer in its first stage, and iodine forms no exception to this statement. By some its efficacy is regarded as unquestionable, while others, and the greater number, probably, discard it as worthless. The latter class, it is true, includes nearly all

[1] Bull. de l'Acad. de Méd., xxiii. 1182. For an illustrative case, vid. Brit. and For. Med.-Chir. Rev., July, 1859, p. 244.

of those who look upon surgical means as including the whole of therapeutics, and the time employed in endeavoring to avert the necessity of a resort to them as worse than wasted. It must, however, be acknowledged that in the case of cancerous tumors, especially of the scirrhous form, there is a period when their structure contains but few of the anatomical elements of cancer, and that these multiply with the tumor's age and growth. Microscopical examination, as well as the fact that many tumors which have for years remained quiescent, may be roused to rapid cancerous growth and degeneration by accidental circumstances, leaves no room for incredulity upon this head. It is during this latent or rudimentary stage that iodine and other medicines besides display their salutary power, and when we cannot but believe they are to be preferred to surgical treatment. That they are so is attested by the numerous examples of the entire removal by their means of tumors condemned to the knife by eminent surgeons. It is wholly illogical to deny that such tumors were really cancerous because they were removed by medicine; to do so is to beg the very question which the facts alluded to prove to be debatable. If a tumor, presenting the characters of cancer, disappears under the use of iodine or any other medicine, that fact constitutes a valid reason why medical means should be employed and systematically persevered in until they are proved by the progress of the disease to be inoperative or insufficient. The use of surgical remedies then becomes justifiable, and it may be imperative. In Bayle's collection, the success of medical treatment is vouched for by Wagner, Ullmann, Hirsch, Magendie, Hufeland, and Osann, to which names we may add those of Gairdner, Klaproth, Zimmerman, Walshe, and Travers in testimony of the occasional success of this method. As before intimated, it is quite possible that in the cases treated by these physicians the true cancerous element was still unformed or devoid of activity, and that the medicine did little more in removing the tumor than destroy the nidus in which cancer-cells would afterwards have been developed under the influence of an inherited cachexia or an accidental injury, or modify that peculiar mode of nutrition, which, and not the formation of new and peculiar cells, appears to constitute the essence of cancerous growth. Even with this limitation, iodine is assuredly too valuable a remedy to be lightly dismissed from the treatment of tumors supposed to be cancerous. It may be added, that, apart from whatever curative virtues it possesses, iodine, in the form of tincture or lotion, forms a useful application for correcting the fetor, and diminishing the discharge, of ulcerated cancerous tumors.

Aneurism.—In 1868 Dr. Balfour[1] made the following statement respecting the use of iodide of potassium in this disease. Of fifteen cases in which the treatment was persistently carried out, in all save one—and that a perfectly hopeless case—a marked relief to suffering was secured; in twelve there was a diminution in the size

[1] Edinb. Med. Journ., xiii. 1055; xiv. 33, 89; xv. 47; xvi. 935.

of the sac, while in a few there was so complete a subsidence of the tumor and relief of all the symptoms as to amount to an apparently perfect cure. The medicine was administered in doses varying from five grains to thirty, three times a day. Dr. B. admitted that the treatment, in order to be effectual, must be continued steadily for at least a year, during which time the patient must remain absolutely quiescent on his back, and make use of such diet only as may be necessary for his sustenance. In claiming for this treatment a singular degree of efficacy, its proposer also admits that there must be many cases of aneurism in which the size, structure, relations, etc., of the tumor must modify the chances of cure materially, but that in almost all it secures a remarkable mitigation of the more distressing symptoms. Without attempting to throw discredit upon its value, we may be permitted to suggest that the share of the iodide of potassium in its results is at least open to criticism, since the other elements of the treatment, rest and diet, have long been known to retard the progress of aneurismal tumors, and even to cause their contraction.

Pulmonary Consumption.—In this affection iodine was vaunted as a cure by Berton, Chevallier, Elliotson, Martin-Solon, Bardsley, and others. Dr. Murray, of Belfast, Dr. Corrigan, of Dublin, and afterwards, Sir Charles Scudamore, eulogized the efficacy of its vapors in consumption. The last-named physician employed inhalations of the vapor from a solution composed as follows: Iodine and iodide of potassium, of each six grains; distilled water, five ounces and six drachms; alcohol, two drachms. A drachm of this mixture, with thirty minims of a saturated tincture of conium, or, when there was spasmodic cough, some ethereal tincture of lobelia, was directed to be mixed in an inhaler half full of water at 120° F., and inhaled for ten, fifteen, or twenty minutes. It is important that the tubes be of large calibre, and the quantity of the solution be gradually increased.[1] This treatment was only intended to be an auxiliary to the approved remedies in consumption, but it was found well fitted to allay the cough, diminish the bronchial secretion, and favor the efforts of nature in cases where a suspension of the disease tends to take place.

More recently, M. Piorry, of Paris, without any reference to the earlier trials and comparative failure of iodine inhalations, has vaunted his success in their use.[2] His patients were made to breathe in a wide-mouthed jar containing either a scruple of iodine, or some of the tincture, the vapors of which were disengaged by heat. They were, moreover, obliged to sleep in an apartment in which iodine was exposed to the air. The majority of them took from twenty to sixty grains of the iodide of potassium daily, and were kept upon a very nutritious diet. The ultimate results claimed for this method were, decided improvement in the symptoms and anatomical characters in twenty consumptive patients;

[1] Lancet, June, 1841, p. 492.
[2] Comptes Rendus, Jan. 1854, and RANKING's Abs. (Am. ed.), xx. 70.

disappearance of the physical signs and most of the symptoms in seven cases; death without improvement in four. M. Piorry believes that iodine causes the induration around tuberculous deposit to diminish, that it probably may favor the removal of tubercles, and that it promotes the healing of cavities. We do not learn that results so strikingly favorable have been obtained by other physicians, although many have made iodine inhalations the subject of a special study. They probably have never cured tubercular phthisis, although they frequently diminish the bronchitis which complicates and aggravates it. The deposit of tubercle takes place from within, and if it is to be prevented, the prophylactic agent must be applied through the blood. If the disease is to be cured, the remedy must, in like manner, approach it upon the side, where alone it can be subjected to vital operations. Some physicians have believed that an application of tincture of iodine over the indurated portion of a tuberculous lung will tend to promote the resolution of the tissue. We have no faith in its efficacy in this respect, but it may possibly diminish the congestion of the organ around the induration.

Iodide of iron has been much used in the treatment of phthisis. It is a convenient form under which to exhibit ferruginous preparations in this disease, which is so often marked by an extreme degree of anæmia, but there is no evidence whatever of its superiority to other medicines of the same class. It has been attempted to bring *cod-liver oil* into the list of iodic remedies, although this product contains a proportion of iodine not exceeding the one-two-thousandth part. If it is efficacious in the cure of consumption, assuredly it is not to this infinitesimal quantity of iodine that its virtues are owing.

Mr. Waring-Curran used with great advantage, in *diphtheria*, inhalations of the vapor of an infusion of sage in vinegar, to which was added on being used a solution of iodine and iodide of potassium in alcohol and water.[1] *Coryza* may sometimes be arrested by snuffing the vapors from tincture of iodine, or by the internal use of full doses of the iodide of potassium. In the latter case the medicine doubtless acts substitutively, since we know that an artificial coryza is sometimes excited by the iodide.

Dropsy.—Iodide of potassium has been employed successfully in several cases of *ascites* which apparently depended upon enlargement of the liver.[2] Dr. Kissam, of Hartford, cured a case of the same description,[3] and Bradfield one of ascites with œdema of the lower limbs by means of this medicine internally, and an iodine liniment applied to the legs.[4] It also cured similar cases in the hands of Dr. A. T. Thomson,[5] Dr. Cummings,[6] Dr. Stokes, and others. Dr. Sieveking cured *hydrothorax* of an aggravated character by the internal administration of iodide of potassium.[7]

[1] Lancet, Sept. and Oct. 1867, pp. 357, 513.
[2] Hospital Facts and Obs., p. 126.
[3] Boston Journ., vol. x.
[4] Lancet, June, 1829, p. 368.
[5] London Dispensatory, p. 496.
[6] Lond. Med. Gaz., xvii. 13.
[7] Times and Gaz., March, 1857, p. 300.

In that most hopeless of all forms of disease attended with serous effusion, *acute hydrocephalus* (*tubercular meningitis*), iodide of potassium has appeared to be the cause of recovery in a number of instances, of which the following may be taken as examples. Roeser reports the case of a child who had been ill for six days, and was insensible, with fixed and dilated pupils, complete paralysis of the right side, automatic movements of the left side, difficult deglutition, and a frequent pulse. Calomel had been given ineffectually, when iodide of potassium, in the dose of a drachm in the course of twenty-four hours, was prescribed. In two days amendment was visible. In a week consciousness returned, and a crop of boils broke out on various parts of the body. In three months the cure was complete.[1] A case of not inferior success was treated by Alken, of Bergheim, but in it calomel and iodine were used together.[2] So Wœniger, of Hamburg, in a case resulting apparently from a blow, applied the remedy with success after calomel and the other usual means had failed.[3] Golfin, of Montpellier, has published three cases which he appears to have cured by means of an ointment containing protiodide of mercury, iodide of potassium, and camphor. This gentleman declares that since he adopted the method alluded to, the greater number of his patients in the second and even in the third stage of the disease have recovered.[4] Several cases apparently in desperate condition are reported by Mr. Fluder to have been saved by this medicine administered after mercury.[5] Dr. A. Fleming claims the cure of a case of tubercular meningitis by its means,[6] but as the symptoms were those of acute meningitis following a discharge from the ear, it is more than probable that no tubercular element was involved.

A case also occurred to Dr. Guérard, of Beaufort, S. C., of *chronic hydrocephalus* occurring soon after birth, and cured in six months by the iodide of potassium.[7] Two most aggravated and apparently hopeless cases of this disease recovered under the same treatment in the hands of Dr. Carson, of Coleraine, Ireland.[8] In all of the instances above referred to, more or less mercury had been administered before the iodide of potassium, or in conjunction with it, so that we are not entitled to attribute the cures to the latter medicine alone. More recently Dr. Coldstream[9] has claimed for the iodide itself a power of curing the disease in question. But he has not furnished any definite grounds for his statement, nor does he appear to have been acquainted with what had already been accomplished. M. Bourrousse claims to have cured eight cases of this disease by doses of about five grains of the iodide alone repeated every three or four hours from the first development of the attack.[10]

Eneuresis, or *incontinence of urine*, in children has been very suc-

[1] Edinb. Month. Journ., October, 1841, p. 748.
[2] DIERBACH, Neueste Entdeck, ii. 1026.
[3] Ibid., iii. 1007.
[4] BOINET, Iodothérapie, p. 774.
[5] Lond. Med. Gaz., Sept. 1842, p. 23.
[6] Brit. Med. Journ., April, 1871, p. 443.
[7] Am. Journ. of Med. Sci., Jan. 1851, p. 109.
[8] Times and Gaz., March, 1859, p. 245.
[9] Edinb. Journ., v. 503.
[10] Bull. de Thérap., lxi. 185.

cessfully treated by Barclay, with the syrup of iodide of iron. In upwards of twenty cases there was not one of failure. The medicine was prescribed in doses of fifteen minims to be taken at meal times.[1] The same affection in old persons has been successfully controlled by the administration of one or two drops of tincture of iodine every two or three hours during the day.[2]

In general *anasarca* independent of organic disease, iodide of potassium is often serviceable. In 1835, Coster published several examples of its success.[3] Osborne cured this affection by means of friction with a liniment composed of tincture of iodine, soap liniment, and oil of turpentine; and Graves spoke of the administration of the iodide of potassium with the greatest confidence.[4] In some cases of *ovarian dropsy* it was successful when used by Gairdner and by Baron, and Dr. Thomson says that in two instances he used it after paracentesis with advantage, but adds that his hopes of its utility had not been realized. It is said to have cured *œdema of the glottis* arising from syphilis. Dr. Sieveking speaks of the eliminative power which it appears to exert in cases of *cerebral apoplexy*[5] after the acute symptoms have subsided. Baudon, Créqui, Caspari, and others claim to have effected cures of *albuminuria* in Bright's disease, by the administration of large doses of iodide of potassium.[6]

Rheumatism.—In *muscular* rheumatism iodide of potassium is often extremely serviceable after the acute symptoms have subsided. It is of comparatively little use in *acute articular* rheumatism, although cases cured by its means have been reported by Campbell,[7] Weber, and Oulmont,[8] but in the *chronic* form, the more exclusively the fibrous tissue is affected, whether of the joints or of the shafts of the bones, the more favorably does the remedy operate. When the periosteum is implicated, it gives speedy relief, and not unfrequently removes the pain and swelling in the course of a few days. Indeed, so potent is the medicine over this particular form of the disease, that in many instances the cure may be safely intrusted to its unassisted power.[9] On the other hand, when the joints themselves are enlarged, their fibrous investments thickened, and their movements painful, the compound tincture of iodine is said to be preferable to the saline preparation.[10] Several cases of that form of rheumatism which Sydenham described,[11] and which Haygarth termed "*nodosity of the joints*," a disease generally regarded as incurable, have been restored to health by Dr. Lasègue.[12] He treated them with iodide of potassium without any benefit whatever, but found that improvement began and advanced steadily under the use of the compound tincture of iodine. The medicine was prescribed in doses of ten drops, diluted with water or weak wine and

[1] Times and Gaz., Dec. 1870, p. 697.
[2] SCHMIDT, Prager. Vierteljahrs., cix. Anal. 52.
[3] Bull. de Thérap., vii. 51.
[4] Clinical Medicine, p. 541.
[5] Times and Gaz., March, 1857, p. 300.
[6] Bull. de Thérap., lxxiv. 465; Practitioner, vii. 58.
[7] Dublin Hosp. Gaz., Feb. 1858.
[8] Bull. de Thérap., liv. 325.
[9] FULLER on Rheumatism (Am. ed.), p. 298.
[10] DELIOUX, Bull. de Thérap., xlix. 241.
[11] Works, Syden. Soc. ed., i. 255.
[12] Archives Gén., Sept. 1856, p. 300.

water, and taken at or after breakfast and dinner. A case of the success of this treatment in the hands of M. Gintrac has been published.[1] It has also been lauded by M. Trousseau.[2] In a very inveterate case of the disease we tried it perseveringly without the slightest benefit.[3]

In chronic *gout* iodide of potassium has frequently been used with advantage, and a late writer has set a high estimate upon its powers in this affection. Dr. Spencer Wells says: "I have given it very extensively for the last thirteen years, in almost all forms of gout, except during the acute attack, and in almost every case with the most encouraging results. I have tried it in doses from eight grains three times a day, to one grain daily, in divided doses, ... and its good effects were too uniform to leave any doubt as to the value of the remedy. . . . . . Except in cases of combination with syphilis, one grain three times a day is as much as can be given for any length of time with benefit and safety."[4]

In 1840, Graves, of Dublin, first drew attention to the effects of iodide of potassium in subacute and chronic *lumbago* and *sciatica*, by publishing an account of its prompt and complete efficacy in an attack of the former affection under which he was laboring.[5] Dr. Osbrey also found it an excellent remedy.[6] Several favorable cases, of one of which he was himself the subject, are reported by M. Izarié. After ten days of suffering with lumbago, the pain yielded almost to the first dose of the medicine.[7] Payan used frictions with iodide of potassium upon the loins with marked relief in a number of cases of lumbago. In that *rheumatic form of neuralgia* which frequently attacks the face, and appears to proceed from cold, Dr. Watson found a few doses of iodide of potassium, of five grains each, to work a speedy and permanent cure. Dr. Oliver, of Mass., used it in his own person with great advantage for relief of *angina pectoris*.

Dr. Casey reports that he employed iodide of potassium in twenty-five or thirty cases of *asthma*, some of them very severe and aggravated, and in no one instance did it fail "to afford unequivocal and decided relief."[8] He gave from two to five grains three times a day in solution. It does not, however, appear what form of "asthma" is here referred to, the purely nervous affection, or that connected with emphysema and catarrh, or chronic bronchitis, or with cardiac disease. The first form is hardly the one intended, since few private practitioners have met with twenty-five or thirty cases of it in a lifetime; and as regards the other forms, as they are essentially incurable, it is probable that a temporary suspension of the attacks has in some cases been mistaken by the reporter for a cure. It is proper to mention, however, that a writer in the *Boston Medical*

[1] Bull. de Thérap., liv. 187.
[2] Abeille Méd., xviii. 446.
[3] Under the head of *Mercury* will be found some account of the use of biniodide of mercury in this disease.
[4] Pract. Obs. on Gou., 1854, pp. 219 and 248.
[5] Dublin Quart. Journ., xviii. 244.
[6] Ibid., xxi. 430.
[7] RANKING's Abstract (Am. ed.), xvi. 71.
[8] N. Y. Journ. of Med., iv. 33.

and Surgical Journal states that he had tried the iodide in a number of cases of "asthma" without having been disappointed in its effects in a single instance.[1] In the same journal[2] cases are reported as benefited by this medicine in which it is manifest that the asthmatic phenomena were subordinate to chronic bronchitis, and were not cases of true nervous asthma at all. Indeed, one of the reporters evidently alludes to this affection when he speaks of an "asthma" in which the diaphragm is immovably fixed, and in which the iodide gives no relief, while ether and chloroform are most apt to afford it. Fleury reports as a case of "syphilitic asthma" one which was cured by this medicine.[3] But it is evident that the existence of a syphilitic element was unnecessary to explain the cure.

In some cases of *paralysis* the medicine appears to have been of service, probably when the paralytic condition depended upon pressure made upon the brain, or upon a nervous trunk, by an effusion or a thickening which the iodide caused to be absorbed. In case of a strong, healthy young man, who without evident cause became affected with loss of sensibility and motion with atrophy, of the lower limbs at first, and afterwards of the whole body, this medicine occasioned a perfect cure.[4] In a similar case, paraplegia having arisen without the operation of any external cause, and none of an internal nature apparently existing, we learned, on inquiring, that several years before, the patient had suffered from primary syphilis. No characteristic marks of the constitutional disease had, however, appeared in the throat or upon the skin. A slight and somewhat tender swelling of one of the shins existed. Iodide of potassium was accordingly administered, whereupon the node upon the leg subsided and the paralysis rapidly improved. A case similar in many respects, but resulting in a less perfect cure, is reported by Folet.[5] In a case reported by Dr. Moxon there was at first pain and then paralysis of the third, fifth, and sixth nerves of the left side, followed by impaired innervation of the right upper extremity, a combination of symptoms which led to the location of the disease in the wall of the cavernous sinus. The proof of syphilitic contamination was not absolute, yet recovery took place under the use of full doses of the iodide of potassium.[6] Another in which the cause of the paralysis was obscure, but probably hemorrhagic, recovered under the use of this medicine after the failure of counter-irritants and tonics.[7] Iodide of potassium has been used in cases of *locomotor ataxia*, but without very promising results. In *chorea*, affecting persons tainted by syphilis or scrofula, it has proved useful.

Iodide of potassium has been employed to moderate *excessive lactation*. Rieseberg relates the case of a woman who, owing to deformity of the nipples, was unable to suckle her children, but whose milk nevertheless continued to be secreted profusely. This occurred

[1] Oct. 15, 1857, p. 226.
[2] Oct. and Nov. 1870, p. 264; p. 350.
[3] Lancet, March, 1865, p. 267.
[4] TAYLOR, Times and Gaz., July, 1863, p. 37.
[5] Bull. de Thérap., lxxiii. 90.
[6] Trans. Clinical Soc., v. 45.
[7] Bull. de Thérap., lxxv. 186.

in her second and also in her third confinement, and on both occasions the secretion was arrested by the internal use of the compound solution of iodine.[1] M. Rousset, of Bordeaux, has published twenty cases intended to demonstrate this virtue in the medicine, when given to the extent of eight or ten grains, in divided doses, in the course of the day.[2] In the *vomiting of pregnancy* iodine seems to be a remarkably successful remedy. Dr. Schmitt, by administering two drops of the tincture every two hours, to a woman, who, in consequence of vomiting, had had four abortions, enabled her to complete her fifth pregnancy securely; and Dr. Eulenberg succeeded in relieving one who had become very much reduced by vomiting during gestation, by giving her, every three hours, three drops of a solution of a scruple of tincture of iodine in three drachms of alcohol.[3] M. Becquerel and M. Buisson used for the same purpose one part, by weight, of tincture of iodine, and one and a half parts of iodide of potassium, dissolved in thirty parts of water, of which a tablespoonful, diluted in a glass of sweetened water, was directed to be taken in three doses during the day. M. Buisson has reported three examples of its complete success.[4] Dr. Masson also mentions five cases in which he succeeded in arresting this distressing and dangerous symptom, by administering, every morning in a glass of sweetened water, three drops of a mixture of one part of tincture of iodine with five and a half parts of alcohol.[5] *Salivation during pregnancy* has been arrested by the use of pastilles, each containing a grain of iodide of potassium.[6]

Strumpf states that it is of "unquestionable advantage" in cases of *barrenness* and inability to procreate,[7] probably when this condition depends upon general debility. When *amenorrhœa* occurs under similar circumstances, iodine is sometimes of service; in this affection and in *dysmenorrhœa* it was originally recommended by Coindet, particularly where general debility and a strumous habit existed. Under like conditions of the general health it is useful as a remedy for *leucorrhœa;* but in all of these cases it should be associated with iron.

Friedreich, of Leipsic, gives a summary of nine cases of *ulcerative stomatitis* occurring in scrofulous persons, and cured by a solution containing one and a half grains of iodine and three grains of iodide of potassium, to four ounces of water.[8] Iodide has also been given with advantage in cases of *ozæna*, probably of syphilitic origin.

Topical Application of Iodine.—Like other substances endowed with an irritant action, iodine is employed as a substitutive and also as a revulsive remedy; in the former case being directly applied to the inflamed or otherwise diseased surface, and in the latter to the sound skin to relieve internal inflammation. When used to

[1] BOINET, op. cit., p. 782.
[2] Bull. de Thérap., lv. 38; Times and Gaz., Oct. 1863, p. 365.
[3] Times and Gaz., Nov. 1856, p. 527.
[4] Bull. de Thérap., liii. 474.
[5] Abeille Méd., xiv. 268.
[6] Bull. de Thérap., liii. 238.
[7] Handbuch, ii. 692.
[8] DIERBACH, op. cit., ii. 1015.

establish a new and healthy action in the place of a morbid one, its action is something more than irritant, and when applied as a revulsive there is, probably, also some absorption of iodine, and consequently a direct action upon the nutritive process.

Erysipelas.—In the more superficial forms of this affection, the application of tincture of iodine is frequently sufficient to arrest the disease. Dr. Ross, in Scotland, found it useful in the form referred to, and also in œdematous erysipelas occurring in an old cachectic subject.[1] Dr. Norris, of Edinburgh, claims to have cured at least thirty cases of the disease by this treatment conjoined with purgatives, tonics, etc., according to the nature of the particular case.[2] The physicians of Boston have given very decided testimony on this subject, by reporting a number of cases, equal to the above, in which the local use of tincture of iodine appears effectually to have arrested the development of erysipelas of the face.[3] In several other superficial inflammations, having a certain analogy with erysipelas, this application has been found equally useful. These are *burns*, *scalds*, and *chilblains*. In the last it is beneficial, like many other stimulant agents, providing that the inflammation is not active, and the skin is unbroken.

To Prevent Pitting in Smallpox.—In 1844, Dr. Crawford, of Montreal, published an account of his having employed the compound tincture of iodine for this purpose in consequence of the decided benefit he had derived from its use in erysipelas. In 1845 Dr. S. Jackson (formerly of Northumberland, Pa.) resorted to a similar expedient. He found that in one case it prevented the maturation of the pustules and the swelling of the skin, and rendered the pits more superficial than where the application was not made. Dr. Goddard applied the remedy successfully in five cases, and Dr. Sargent used it at the smallpox hospital of Philadelphia; but although it greatly mitigated the inflammation, it did not prevent pitting.[4] Similar experiments were made by Dethier at the Hospital of Mons, and with the same general results, but it is not stated to what extent the pitting was prevented.[5] In 1854 Dr. Crawford again drew attention to the method, in which he continued to have undiminished confidence. He employed a saturated tincture of iodine, applying it with a brush to the face and other parts of the body once or twice every day from the commencement of the eruption.[6] Boinet goes so far as to say that he has frequently made use of this preparation in confluent smallpox, and has "always seen the variolous pustules abort without inconvenience to the patients."[7]

In various *diseases of the skin* iodine has been employed with occasional success both internally and locally, but, except in those

[1] Month. Journ. of Med. Sci., Sept. 1842, p. 792.
[2] Bull. de Thérap., xlv. 172.
[3] Bost. Med. and Surg. Journ., Sept. 1855, p. 140. For other cases see LANYON, Lancet, June, 1840, p. 484.
[4] Philad. Med. Exam., Aug. 1846, p. 464.
[5] Abeille Méd., xii. 293.
[6] New York Journ., N. S., xii. 137.
[7] Op. cit., p. 647.

which depend upon constitutional syphilis, its virtues have not been very clearly exhibited. Doubtless it may in both modes occasionally cure *psoriasis*, *herpes*, *acne*, and even *favus*, but none of them as certainly or as speedily as other remedies. Hebra declares that its internal administration is nugatory in all non-syphilitic diseases of the skin. With *lupus* the case is somewhat different. This is an affection generally engrafted upon a scrofulous constitution, and on that account, probably, is more amenable to the internal administration of iodine than the other cutaneous diseases mentioned. To obtain its full benefits, however, the remedy must be continued for a long time, and in very moderate doses, not exceeding a grain, two or three times a day. As an external remedy in lupus, the tincture of iodine is too feeble to be of much service. A solution of one part each of iodine and iodide of potassium in two parts of glycerin forms an active caustic which may be very advantageously used in the treatment of lupus and other obstinate local degenerations of the skin. An ointment made by melting together one part of sulphur and two of iodine, and mixing with one part of this compound eight parts of lard, is recommended by Hebra as a superficial caustic in *acne rosacea*, *sycosis*, etc. It should be applied as a plaster and renewed morning and evening according to the degree of its operation. The tincture has sometimes been found successful as an application for the cure of *warts*, soft *corns*,[1] and vascular *nævi*. A solution of iodide of potassium may be used to remove *stains* produced by *nitrate of silver*. The stains should be moistened thoroughly with the solution, and exposed to the sun.

Various *mucous fluxes* have been cured by the local application of the tincture or the solution of iodine. Lugol employed the latter, when diluted, as an injection into the nostrils in *ozæna*. *Chronic laryngitis* may be treated advantageously by iodine inhalations, and by tincture of iodine applied to the skin of the fore part of the neck. The same means should be tried in *aphonia*, arising either from debility and relaxation, or from chronic thickening of the laryngeal mucous membrane.[2] M. Ancelon found the application of tincture of iodine to the pharynx, by means of a probang, very efficient in overcoming *spasm of the œsophagus*.[3] Chronic thickening and induration of the neck of the *uterus* is more benefited by the topical application of a solution of iodine than by any other remedy whatever. In *leucorrhœa* it has been successful when applied thoroughly, by means of a mop and speculum, to the whole vaginal surface and os uteri. It may be used with peculiar advantage in uterine leucorrhœa. Dr. Russell, of Louisiana, states that he used a solution containing from one to four grains of iodine, with double the quantity of iodide of potassium, in an ounce of water, as an injection, with better effects than those obtained from the nitrate of silver.[4] A similar treatment has been found success-

[1] Bull. de Thérap., iv. 141.
[2] BENNET, Times and Gaz., Jan. 1858, pp. 116, 138.
[3] Bull. de Thérap., iv. 92.
[4] N. Y. Journ. of Med., April, 1854, p. 398.

ful in the cure of *gleet*. Two drachms of tincture of iodine in an ounce of water form a solution which should be injected night and morning for several days. Boinet cured several cases of chronic *catarrh of the bladder* by means of an injection containing one part of tincture of iodine in twelve of water. After drawing off the urine, the solution was injected through a catheter, and allowed to remain for about three minutes. An emollient injection followed. A similar solution, given as an enema, has been found effectual in the cure of *chronic dysentery*.

The compound tincture of iodine forms a valuable application to *ulcers of the tonsils*, whether specific in their nature or not. It has been highly recommended by Dr. J. J. Ross, and by Ricord, who says that he does not know anything equal to it in such cases. A gargle may be used of the following composition: ℞.—Tr. iodini, f℈j to f℈ij; tr. opii, f℈j; aquæ, f℥vj.—M. S.—Gargle three or four times a day. It is equally applicable to *granular inflammation* of the fauces. Dr. H. F. Campbell cured an obstinate case of *scrofulous ozæna* in less than a month, by the application, three or four times a day, of two grains of iodine dissolved in an ounce of glycerin.[1] Dr. Norman Cheevers found that a gargle containing from two to five fluidrachms of the compound tincture of iodine in eight ounces of water "exerts an absolutely prophylactic or curative influence" on *mercurial ptyalism*. He relates several cases which show that it is capable of arresting this process with singular promptness.[2] There is an affection of the *gums* which consists in their wasting and retraction, causing the teeth to loosen and rendering the breath fetid. Sometimes it is connected with a formation of tartar, but quite as frequently has no apparent cause unless it be dyspeptic disorder. But the gastric derangement is also in its turn a consequence of the infirm condition of the teeth which renders them inapt for mastication. A very weak solution of iodine in water (as a grain to the ounce) forms the best application for the cure of this infirmity, for which a very sagacious and experienced dentist once assured us that he knew no remedy. The application should be made with a camel's hair brush after each meal, and the mouth immediately afterwards rinsed with pure water. In various chronic inflammations of the eyes the local use of iodine has been found an excellent mode of stimulation, particularly in the several varieties of *scrofulous ophthalmia*, such as granular inflammation of the conjunctiva, blepharitis, etc. In some of these cases the vapor of a solution of iodine in chloroform has proved of great service.[3] A solution of iodine and iodide of potassium has been used successfully to dissolve and remove a *scale of iron lodged in the cornea*.

In cases of *indolent glandular inflammation*, including that of the inguinal glands, it has been found useful to apply a solution of iodine upon and around the affected gland, or to have iodine oint-

[1] Am. Journ. of Med. Sci., April, 1859, p [illegible]
[2] Indian Annals; and Am. Journ. of [illegible]
[3] Boston Med. and Surg. Journ., N[illegible]

ment daily rubbed into the affected part. The tincture is recommended by Dr. H. C. Stewart as having in many cases prevented the formation of *mammary abscess*.[1] Bonnet, of Lyons, reports the cure of a case of *pleurisy*, with large effusion, which resisted various modes of treatment until iodine ointment was applied to a blistered surface upon the affected side of the chest.[2] The same effect has followed painting the skin with tincture of iodine.[3] This latter method has also been used with advantage to relieve *pleuritic stitches*. Norris, of Edinburgh, employed it in puerperal *peritonitis*,[4] and others have, with more probability of advantage, used it in the chronic forms of peritoneal inflammation occurring in strumous subjects. It is likewise serviceable in *hydrarthrosis*, or fluid effusion within the joints, and in all cases of fibrinous exudation, whether involving the articular ligaments or the periosteum only. In all cases in which the skin is unbroken, the iodine probably acts as a counter-irritant, and is but little if at all absorbed.

The late Dr. Brainard, of Chicago, proposed iodine as a means of neutralizing *animal poisons* introduced into wounds, whether derived from venomous animals, or the products of animal decomposition. The latter application of iodine has been illustrated by M. Boinet, in the treatment of gangrenous and ill-conditioned suppurating cavities, to prevent purulent absorption and its consequences. It appears that iodine has the property of disinfecting the secretions of such diseased surfaces, while by its coagulating action upon the fluids in the substance of the walls of the abscesses, it erects a physical barrier to absorption. When a virus such as that of the mad dog, of glanders, or of a venomous animal is inoculated, the application should be made immediately, and a large cupping-glass retained for some time over the wound. Dr. Brainard recommended, in addition, the injection of a solution of iodine into the cellular tissue around the wound. This physician also injected a solution of iodide of potassium into the subcutaneous cellular tissue for the removal of serous and fibrinous effusion, as in œdematous erysipelas.[5]

Injection into Serous Cavities.—It has been already stated that iodine, although an irritant, does not excite suppuration unless a very strong solution of it is employed, but only occasions an adhesive inflammation. This singular property has been applied to the treatment of various forms of dropsy. It was first employed in 1832, by Martin, of Calcutta, for the radical cure of *hydrocele*, and speedily became the ordinary method. A mixture of one part tincture of iodine with two parts of water is thrown into the cavity of the tunica vaginalis after the evacuation of its serum, and is allowed to remain for five or six minutes. It seldom occasions pain unless the part is compressed, but some fever usually follows,

[1] Philad. Med. Exam., May, 1853, p. 292.
[2] Bull. de Thérap., xliv. 88.
[3] M. VAULPRÉ reports five cases of its complete success. Bull. de Thérap., lii. 80.
[4] Bull. de Thérap., xlv. 172.
[5] Am. Journ. of Med. Sci., April, 1852, p. 563.

and continues for several days. The result is nearly always a successful one, if the operation has been performed with care. In eleven hundred and forty-eight cases treated with iodine injections, only three failed; and these injections succeeded in nine cases where the previous use of port wine and sulphate of zinc had proved ineffectual.[1]

A similar injection had been used to cause obliteration of the sac in reducible *hernia*, and thus prevent a recurrence of the accident. Velpeau, more than any other surgeon, extended the use of iodine injections to the cure of all those tumors formed by a collection of synovial fluid in the *bursæ* and *sheaths* of tendons. The inflammation excited by this procedure is said never to become phlegmonous or to be accompanied by alarming symptoms. The same surgeon, and Bonnet, of Lyons, divided the honor of applying this method to the treatment of *white swelling* or *hydrarthrosis*. Boinet expresses the following opinion of its value. "It is proved by experience, that the method is not a dangerous one. It has in no instance occasioned death, and in most cases it has succeeded. It has never given rise to phlegmonous inflammation, and has cured the disease when it was not complicated with caries, necrosis, articular fungus, or swelling of the surrounding soft parts. Even in these unfavorable cases it was beneficial."[2] The immediate consequences of the operation are stated to be considerable local pain, and fever for several days, but nothing that requires active treatment, or which need create anxiety; and the ultimate result, if not a cure, is said at least never to be an aggravation of the symptoms or anchylosis of the affected joint.

The injection of a solution of iodine into the abdominal cavity has been used for the cure of *ascites*, in certain cases, independent of organic mechanical causes. The earliest operation of this nature was performed in 1840, by Dieulafoy, of Toulouse.[3] It was first employed in this country by Dr. Brainard, in 1845.[4] The strength of the injection employed has usually been about one fluidrachm of tincture of iodine, and five grains of iodide of potassium to eight fluidounces of water. Boinet collected thirteen cases treated by this method; of these, eleven were successful, and in the two cases that were not so, no serious consequences ensued. M. Gintrac, Jr., of Bordeaux, considers the operation as contraindicated in all cases in which an organic affection of the heart, lungs, great vessels, alimentary canal, kidneys, uterus, etc., exists, and whenever the liquid evacuated by the trocar is purulent.[5]

The symptoms following the operation are described by him, and also by Boinet, as generally slight. There is reason to believe that the results here stated are more favorable than are always obtained. Dr. Spengler, of Ems, resorted to this method in a case of ascites depending upon hepatic disease. The operation was performed twice unsuccessfully, and the death of the patient occurred soon

[1] SOUTH'S CHELIUS (Am. ed.), iii. 237.
[2] Op. cit., p. 320.
[3] Bull. de Thérap., lxxiii. 8.
[4] Am. Journ. of Med. Sci., Oct. 1850, p. 560.
[5] Bull. de Thérap., xlix. 130.

after the second injection.[1] Dr. Cyprien Oré, of Bordeaux, performed the operation in five cases, and two only were cured. It is true that in the others death is said to have been due to causes independent of the operation.[2] Its effects are thus described by Dr. Oré. No sooner is the solution of iodine injected than the patient turns pale, his limbs grow cold, his pulse sinks, and he experiences severe pain in the abdomen. These symptoms, however, are speedily followed by a moderate degree of reaction. In the cases which terminated fatally, there was general adhesion of the peritoneal surfaces, by means of false membranes. In a case operated upon successfully by M. Jules Roux, the patient died three months afterwards of typhoid fever, when extensive adhesions of the intestines were found, and the free portion of the peritoneal membrane was of a slate color, and had a metallic lustre.[3] Teissier, of Lyons, who has been one of the most strenuous advocates of the operation, introduced several important practical modifications into its execution, which, according to him, diminish its dangers, and promote its success. One of these consists in retaining a certain proportion of the ascitic fluid in the abdomen before injecting the iodized solution, and another in proportioning the strength of the injection to the quality of the effusion. Thus it is recommended to render the solution strong in proportion to the degree of alkalinity of the dropsical liquid; to employ a watery solution of iodine if the fluid drawn off is very albuminous, etc.[4] In spite of these wise counsels, and the reported success of their author and of several others who adopted the practice in one or another form, the operation does not appear to have been favorably judged, or generally adopted.[5] Indeed, the number of cases of abdominal dropsy entirely independent of organic lesions, is so extremely small, that a case apparently of idiopathic origin may well inspire doubts of the correctness of such a decision as to its nature, and of the risk of attempting to arrest an exhalation which, under the circumstances, must be regarded as salutary rather than as mischievous.

Injecting the pleural cavity for the cure of *chronic pleurisy* is an ancient practice. Simple puncture of the thorax is generally successful when the distending liquid is serous, and as generally fatal when it is purulent, but in the latter case the issue can often be rendered favorable by the use of stimulating injections, and especially of those containing iodine. For this method we are indebted to M. Boinet, who attributes to it the following advantages: it corrects at once the fetor of the pus, and so modifies the condition of the pleural surfaces as to render a cure possible even in cases supposed to be necessarily mortal. His mode of procedure is to evacuate the pus very gradually during a period of several days, then to wash out the chest with thin mucilage, and immediately afterwards to inject the iodized solution. This should be very

[1] CANSTATT, Jahresbericht, 1852, p. 103. [2] Bull. de Thérap., xliii. 241.
[3] Archives Gén., Oct. 1855, p. 479. A case of cure of inveterate ascites by this treatment is recorded in Brit. and For. Med.-Chir. Rev., Jan. 1862, p. 232.
[4] Bull. de Thérap., xlv. 145; 298. [5] Bernier, Ibid., lxxiii. 5.

weak if the case is a recent one, *e. g.*, four or five grains of iodine, and as many of iodide of potassium, in a pint of water. But much stronger solutions have sometimes been used, as one part of the compound tincture of iodine to ten of water, or even, as in a case of M. Aran, one part of iodine to two of water, with the addition of iodide of potassium. In this case, which terminated in cure with retraction of the side, the constitutional effects of iodine were evident.[1] The injections ought to be repeated every third or fourth day according to the changes produced in the discharge, and in quantity they should be proportioned to the size of the pleural cavity. A very interesting instance of the perfect success of this method is reported by Dr. Brainard. The patient was a boy, sixteen years of age, and the empyema followed a pleurisy, caused by a wound with a knife. A solution consisting of one grain of iodine, three grains of iodide of potassium, and an ounce of water was injected, twice a day.[2]

Dr. Brainard was the first to propose and make use of injections of iodine for the cure of *spina bifida*, or, more correctly, of *hydrorachis*. His patient was a girl thirteen years of age, partially paralytic in the lower extremities, and idiotic. She had a fluctuating tumor over the sacrum three inches in diameter. Into this was injected, without evacuating it, a drachm of water holding in solution one grain of iodide of potassium and half a grain of iodine. Diminution of the tumor followed. A second operation of the same sort was performed three weeks afterwards, and the swelling continued to subside.[3] From the result of this and other cases, Dr. B. regarded hydrorachis as generally in itself a curable disease; but its complications may render the operation by injection, or any other operation, inexpedient or even fatal.[4] Cases have also been operated upon by Chassaignac and by Velpeau, which terminated in complete cure.[5] These surgeons, instead of injecting a weak watery solution into the still distended tumor, preferred evacuating the latter, and employing an injection containing from one-third to one-half of its bulk of tincture of iodine, and which was not allowed to remain in the cavity more than a minute.[6] Two successful cases of this operation are reported by Caradec, in infants, the one a month old, the other two months old,[7] and a third by Mr. Coates, in a child three months of age. In the last case the fluid in the tumor was partially withdrawn, and the solution of iodine injected, by means of a hypodermic syringe.[8] A case of the complete success of this method is reported by Roux, in which an enormous tumour in a child six weeks old was evacuated and then injected with the following solution: Distilled water 40 grammes, tincture of iodine,

[1] Bull. de Thérap., xliv. 54. [2] Am. Journ. of Med. Sci., July, 1858, p. 289.
[3] Ibid., July, 1848, p. 262.
[4] Ibid., Oct. 1850, p. 560; Oct. 1860, p. 572; July, 1861, p. 65.
[5] Bull. de Thérap., xiv. 65, and xlvi. 123.
[6] In 1860 the operation had been performed in France ten times. It was successful six times, unsuccessful once, and fatal four times. (Bull. de l'Acad., xxvi. 127.)
[7] Bull. de Thérap., lxxiii. 280. [8] Lancet, March, 1866, p. 225.

10 grammes, and iodide of potassium ten centigrammes.[1] In this case the injection was not allowed to remain. In a case of Dr. Nicholls[2] about twenty drops of tincture of iodine in three drachms of distilled water were injected and retained. The child, eighteen months old, made a perfect recovery. Another case in a child two months old, with a tumor about the size of an orange, was treated by Dr. Morton by only partially evacuating the liquid and injecting an ounce of glycerin, holding in solution ten grains of iodine and thirty grains of iodide of potassium.[3] This method has been tried in *hydrocephalus*, but, generally, it would seem, without success.[4] In a case treated by Dr. Tournesco, of Bucharest, the patient, a child two months old, not only survived the operation, but the head, after the serum had been evacuated, did not again enlarge, and thirty-five days afterwards the child was in good health. Dr. Brainard, who cites this report, has published a case in which he operated twenty-one times on the same patient in the course of eight months, when the child died.[5]

Cysts.—M. Boinet includes under the title of cellular cysts all shut sacs produced by disease, and constituting in themselves a disease. An abscess is a cellular cyst containing pus. Other varieties contain blood, serum, hydatids, melicerous, or atheromatous matter. The principal seat of these cysts is in the lymphatic glands. Another division includes all cysts resulting from the distension of natural cavities lined by a mucous or sero-mucous membrane. These occupy the thyroid body, the parotid, sublingual, submaxillary, or mammary gland, the liver, the ovary, the bones, etc. It is foreign to the purpose of this work to enter into details respecting these various forms of disease; suffice it to say, as regards the greater number of them, that no method whatever has proved so efficacious in their cure as the one now under consideration. The conclusions of M. Boinet in regard to ovarian cysts, the most common of the graver forms of encysted dropsy, we shall, however, quote more fully. They are as follows:—

"1. Hitherto encysted dropsy of the ovary has been supposed to be incurable.

"2. Simple puncture of the tumor is only palliative, and is sometimes dangerous.

"3. Extirpation is not absolutely to be rejected, since numerous examples of its success have occurred in England, Germany, and America; but it is a very serious operation, and should be employed only for certain varieties of cysts.

"4. A single puncture or successive ones followed by iodized injections duly performed, *have never involved the least danger*, whether the cysts were simple or complicated; they often bring about a

[1] Bull. de Thérap., lxxvi. 27.
[2] St. George's Hosp. Rep., iv. 216.
[3] British Med. Journ., April, 1872, p. 364.
[4] See, among other cases, one reported in the Med. Times and Gaz., Nov. 1855, p. 408.
[5] Boston Med. and Surg. Journ., May, 1859, p. 343.

radical cure, and always a notable improvement, even in cases which are essentially incurable.

"5. The method should be modified according to the size of the cyst, the quality of its contained liquid, the complications, etc.

"6. Serous, simple, unilocular, small, and recent cysts without organic complications, are more readily cured than old, multilocular cysts, etc. Probably few multilocular cysts, or any but simple serous cysts, are curable by this method.

"7. Sometimes a serous cyst, even when very large, is cured by a single injection, but generally more are required.

"8. The injections should be repeated until the cyst is completely obliterated.

"9. It is important to operate as soon as liquid can be detected, and to renew the operation if the cyst re-forms.

"10. The strength of the injection must be modified according to the extent and nature of the cyst, its complications, and peculiarities.

"11. The puncture should be made above Poupart's ligament, and not through the vagina.

"12. It should always be made on the side where the tumor originated."[1]

It is proper also to call particular attention to the remarkable success obtained by the physician above referred to, in applying the same treatment to all kinds of *suppurating cavities*, especially those which are inaccessible to the stimulants commonly employed to promote the cure of superficial ulcers; such as *lumbar and iliac abscesses*, *cold abscesses*, *white swelling*, *fistulæ of the larynx*, *of the anus*, etc. A case of the successful injection of an *hepatic fistula* is related by Dr. Aitken.[2] In regard to *fistulæ in ano*, M. Boinet draws the following conclusions from his experience, viz., that iodized injections cure them more speedily and with less danger and annoyance than any other method; for they are less painful, easier to make use of, do not require the patient to keep his bed for a long time, are applicable to all cases, and especially to those which are unsuitable for an operation; and even if they should fail, the knife remains as a last resort.[3] The same physician has reported cures of cysts of the liver by the method here recommended.[4]

Modus Operandi.—If, in order to determine the nature of the curative influence exercised by iodine, we survey the whole field in which this substance and its compounds operate therapeutically, we are struck by the fact that, like other alteratives, its operation is

[1] Numerous examples of this operation have been published, and among them the reader will find it of interest to refer to the following: Mr. HARDWICK, Times and Gaz., Jan. 1857, pp. 110 and 138; Dr. S. BECK, Ibid., May, 1857, p. 498; Mr. ERICHSEN, Lancet, May, 1857, p. 452; Dr. B. ROEMER, Am. Journ. of Med. Sci., April, 1857, p. 332; Mr. J. B. BROWN, Times and Gaz., Dec. 1857, p. 587; Mr. HUTCHINSON, Ibid., June, 1858; p. 602; Mr. BICKERSTETH, Ibid., p. 655; Dr. SAVAGE, Ibid., May, 1859, p. 548; Dr. D. G. Thomas, Trans. N. Y. State Med. Soc., 1863, p. 258.

[2] Edinb. Journ., xv. 1092.

[3] Op. cit., p. 608.

[4] Bull. de l'Acad., xxvi. 72.

gradual and usually unaccompanied by active phenomena. In dropsy of the great cavities, or of the joints, it appears to effect a cure by a very slow and steady removal of the effusion, and without augmenting in a notable degree, the urine, the perspiration, or the alvine discharges. The same is true in reference to such tumors (simple enlargement of the thyroid body, of the ovaries, the testes, etc.), inflammatory or otherwise, which it is competent to cure. If we turn to other diseases in which its action is useful, such as metallic poisoning, tertiary syphilis, and certain cutaneous eruptions, we find in the first, material proofs of its eliminative power, and, in the absence of any other sufficient explanation of its efficacy in the latter, we may conjecture that, in them, also, it brings about the discharge of some *materies morbi* from the system. If we add to these considerations that the operation of iodine upon the economy, when long sustained, and even in minute doses, is evidently to cause a wasting of the tissues, beginning with the fat and glandular structures, and that it tends to reduce the proportion of the solid constituents of the blood, the conclusion appears to be a legitimate one that it is curative because it tends to eliminate from the system, first, those constituents of the body which are most slightly incorporated with it, and which are, indeed, foreign to its structure, and that its action ultimately becomes pathological instead of salutary, when it promotes the disintegration and discharge of the organic elements themselves.

Antidotes.—When an overdose of iodine or of its tincture has been taken, lukewarm water containing starch, white of egg, or mucilage should be freely administered, for the purpose of inducing emesis and of neutralizing the iodine. Milk is also an appropriate remedy. A solution of carbonate of soda may be given as a chemical antidote. After the amylaceous solution which is thrown up ceases to present a blue tinge, attempts to excite vomiting should be abstained from, and means employed to quiet the local and general excitement. If there is much tenderness or burning pain at the pit of the stomach, leeches may by applied there, and small quantities of iced water or gum-water taken internally. An opiate should at the same time be administered to calm the general agitation as well as the local pain. Black drop, or a salt of morphia in solution is preferable to solid opium. The food for some time should be unirritating and taken in moderate quantity.

Administration.—Besides the special directions given in this article for the administration of iodine, it may be well to add one or two in this place. The tinctures and solutions of iodine should always be prescribed in small doses, at first, and very largely diluted. When they occasion pain, disturbed digestion, etc., they should be temporarily withdrawn, and on being resumed the dose should be diminished. The dose of iodide of potassium, which ought also to be largely diluted, may be gradually augmented until the object of giving the medicine is attained, or symptoms of iodism appear. Externally, iodine may be applied in substance, as already stated, by being quilted in some suitable tissue worn next the skin. The

tinctures and solutions are applied to the skin by means of a camel-hair pencil or some analogous instrument. After repeated applications the integument becomes hard, and it is proper before reapplying the medicine to wash the part with alcohol. If the cuticle exfoliates, it is better not to resume the treatment until this covering is formed anew, or, if this delay is not judged proper, a weaker solution should be applied. When used upon a part which tends to suppurate, a cold water dressing is preferable to a warm poultice. The stain made by iodine can be prevented by using carbolic acid to decolorize its solution. Six drops of the acid will remove the color from a fluidrachm of compound tincture of iodine diluted with six ounces of water. It is also decolorized by soap liniment, by ammonia, and by sulphite of soda.

Uses of Iodoform.—The original application of this compound was locally for the relief of pain, and the result of experience in its use is that it has no other direct operation whatever. It was first applied to open *cancer* of the uterus and subsequently to painful cancerous ulcers of other parts, and the nearly uniform testimony of the many who have employed it is, that it forms a very efficient anodyne and at the same time promotes whatever tendency the sore may have to heal. Precisely the same result of its use in the treatment of *venereal ulcers* is reported, and it does not differ in regard to other *ulcers*, varicose, traumatic, etc. In some cases of ulcerated anus with *fissure* it has proved a very useful palliative. In these various forms of ulceration the medicine was most profitably used in powder when the sore was indolent, and in solution or in ointment when it was irritable. In both cases it allayed pain, and in that manner promoted normal nutrition; but in the first mentioned it stimulated as well as soothed, while in the last its anæsthetic virtue prevailed. Some few persons have reported the cure of neuralgia by means of iodoform; but as in every case this medicine was associated with iron, there is no ground on which to estimate its utility, if, indeed, it possessed any at all.

The odor of iodoform, which is to many persons exceedingly disagreeable, is neutralized by ether, but to some the substituted smell is equally unpleasant; and in cases to which the pulverulent form of the medicine is best fitted, it is not probable that an ethereal solution would be equally advantageous.

BROMINIUM.—BROMINE.

POTASSII BROMIDUM.—BROMIDE OF POTASSIUM.

AMMONII BROMIDUM.—BROMIDE OF AMMONIUM.

History and Description.—Bromine is an elementary substance obtained from bittern, the mother liquor of sea-water, from which chloride of sodium has been separated by crystallization.

It exists in many marine plants and molluscous animals, and in the water of numerous saline lakes and springs. It was first isolated by Balard, of Montpellier, in 1826, but not until ten years later was it used in medicine, when it was recommended for goitre by Pourché.

At ordinary temperatures bromine is a very thin and volatile liquid of a dark brownish-red color by reflected light; but a thin layer of it is transparent and of a beautiful ruby-red color. Its sp. gr. is 2.966, and it boils at about 117° F. Its odor is strong, pungent, and offensive (hence its name, from βρῶμος, a stink), and its taste astringent, acrid, and burning. Its vapor is not inflammable, and a lighted taper introduced into it is extinguished after becoming red at the upper and green at the lower part. It combines with water forming a hydrate, and dissolves in a large excess of water, it is also soluble in alcohol but more freely in ether. It destroys the color of litmus and indigo, and neutralizes organic odors. It corrodes wood, cork, and other organic substances; turns a solution of starch orange-yellow, and stains the skin of a similar color, which remains until the cuticle exfoliates. It coagulates albumen, losing its color. Fibrin is converted by its watery solution into a bluish gelatinous mass. It disintegrates the red corpuscles of the blood, rendering the mass olive green at first and afterwards gray. It combines both with organic and inorganic substances. In medicine it has been used in combination with iron, mercury, ammonium, sodium, and potassium.

Bromide of potassium is prepared by adding a solution of pure carbonate of potassa to a solution of bromide of iron. The iron is precipitated, and bromide of potassium remains in solution, from which it is obtained by evaporating the liquid. It forms white pearly transparent crystals. They are without smell, and have a sharp, saline taste resembling that of common salt, but more pungent. They are unchanged by exposure to the air, and crepitate when heated. Bromide of potassium is wholly soluble in water, but is sparingly soluble in alcohol. It is decomposed by the stronger acids. When mixed with starch and treated with sulphuric acid it becomes yellow. When the urine of a person taking it is treated in the same manner a characteristic brown color is developed.

Bromide of ammonium is made by acting upon freshly prepared bromide of iron with water of ammonia. Bromide of ammonium remains in solution, and on evaporating the liquid is obtained in the form of "a white granular salt, becoming yellow on exposure, readily soluble in water, and sparingly so in alcohol."

The *bromide of sodium* and the *bromide of lithium* are not officinal preparations, but are employed in practice.

Action. *On Animals.*—The experiments of Höring and of Glover[1] show that the effects of *bromine* are partly due to its direct local action and partly to its absorption. When dogs were con-

[1] STRUMPF, Handbuch, ii. 811; Monthly Journ. of Med. Sci., Aug. 1842, p. 709.

fined in an atmosphere filled with the vapor of this substance it excited a profuse secretion from the eyes, nostrils, and fauces, with cough, hoarseness, and dyspnœa. Upon the stomach it acted as a corrosive irritant, producing vomiting, signs of pain, diarrhœa, and death by exhaustion. On dissection, the mucous membrane of the œsophagus and stomach was found reddened and softened. When vomiting was prevented by ligation of the œsophagus, the animals died by gradual exhaustion preceded by general insensibility. Applied to the shaven hide, bromine produced gangrenous sores.

Experiments on animals with *bromide of potassium* prove that the action of this salt in some respects resembles that of bromine itself, but are of a much milder grade in proportion to the dose. When injected into the veins it occasions tetanic symptoms of a more decided character than when bromine is used, with dilatation of the pupils, and disordered respiration and circulation. After death the arterial blood retains its color longer than usual and coagulated in the vessels.

In 1842 Dr. Glover introduced into the stomach of a male rabbit one hundred grains of bromide of potassium dissolved in three drachms of water. Five minutes after the operation the animal fell flat on his belly; loss of power over the hind legs was apparent, and he made ineffectual attempts to crawl. The breathing became quicker than natural, embarrassed, and abdominal, and the action of the heart irregular and feeble. This state continued for half an hour, during which time the fæces twice escaped, and the iris seemed paralyzed. Tetanic convulsions followed, and death after a few deep inspirations. In 1867 Messrs. Eulenburg and Guttmann performed a series of experiments upon rabbits and frogs, by injecting a solution of bromide of potassium beneath the skin of these animals, from which they concluded that it exercises a powerfully sedative action directly upon the heart, and also upon the cerebro-spinal nervous centres, which control sensibility and motility.[1] Soon afterwards a still more complete investigation of the subject was made by MM. Martin-Damourette and Pelvet.[2] They made use of rabbits, birds, and frogs in their experiments, and found the effects of the medicine identical in all, so far as their nature was concerned, but most easily studied in cold-blooded animals. The results about to be described were observed when the medicine was hypodermically administered to frogs.

Doses of from $\frac{1}{12}$ to $\frac{1}{3}$ gr. produce a remarkably placid and slumberous condition of the animal, slowing the heart's action and contracting the capillaries; and doses from $\frac{1}{3}$ gr. to one grain may cause death. In the latter case there is sometimes a transient muscular quivering, soon followed by impaired sensibility and muscular power, which is first manifested near the point at which the solution was introduced. Paralysis of motion precedes that of sensation. The nerve supplying a limb does not lose its excitability until after the extinction of that function in the skin, nor does that

[1] Arch. Gén., Aug. 1867, p. 238. [2] Bull. de Thérap., lxxiii. 241.

part of the spinal marrow answering to the nerve lose this function as soon as the nerve itself. Voluntary motion appears to be abolished subsequently, and the respiratory movements at a still later period. One of the first effects of poisoning by bromide of potassium is a diminution of the capillary circulation. The rate of movement of the blood through the vessels is first diminished, and then the skin grows pale; the action of the heart becomes more languid, but continues with a steady diminution until death; and indeed this ultimate act of life may survive the other vital phenomena for several hours. The doses which have been mentioned are not always fatal to the frog, but those of one or two grains are so uniformly. If they are introduced near the cardiac region, the usual order of phenomena may be interverted, and death occur by paralysis of the heart, before the loss of function by the muscles, nerves, or spinal marrow. This may result from the application of the bromide in the neighborhood of the heart, or by its direct penetration into the bloodvessels and its transmission by them to the central organ of the circulation. In some cases a congestion of the capillary circulation is observed after large doses of the poison. These differences are also illustrated by the contraction of the pupil in some instances and its dilatation in others, phenomena which the authors we quote refer to differences of primary action of the bromide upon the nerves of the iris. It seems more reasonable to refer them to differences of action upon the bloodvessels of that organ.

On further analysis, it appears that the contact of bromide of potassium in substance with a living muscle paralyzes it, and the same effect is produced upon the muscles of a limb when a solution of the salt is injected into its principal artery. Its direct contact with a nervous trunk paralyzes those parts, and those alone, to which the nerve is distributed; in like manner loss of function ensues when the powdered bromide is applied directly to the spinal marrow or to the brain. In the one case motion and sensibility are abolished, and in the other the animal falls into a somnolent condition, "a true anæsthetic sleep." The respiratory movements are first enfeebled, and then suspended; the latter effect corresponding, in point of time, with the general relaxation of the voluntary muscles. The heart, as before stated, loses its irritability when directly acted upon by the bromide; when the salt is introduced by absorption, and in appropriate quantity, it begins to pulsate more slowly, and even as slowly as eight times in a minute during the anæsthetic state. But it is the last organ to manifest signs of life, and finally ceases to beat while contracted, although it may subsequently become relaxed and distended.[1] Capillary circulation

[1] In regard to the action of bromide of potassium upon the heart, the conclusions from experiments are not uniform. Podcopaew inferred from his observations that the salt is fatal to animals by arresting the heart's action only when it is directly injected into the blood. (*Virchow's Arch.*, xxxiii. 505.) Saison, who performed a number of experiments upon animals with this substance, presents the following among his conclusions: "The heart appears to me to escape entirely the influence

is uniformly diminished, and always first where the salt is directly applied. It is, however, true that a large quantity of the salt applied locally may determine a congestion of the capillaries by paralyzing them. Necessarily, the diminished circulation and the impaired nervous energy of a part, which are produced by the bromide, imply its diminished calorification; and, in point of fact, the temperature of the part to which the salt is applied, and afterwards the whole body of the animal, undergo a sensible diminution of temperature. Of the secretions, all are diminished, except that of the kidneys.

On Man.—According to Höring's experiments, one-seventh of a drop of *bromine* in half an ounce of water occasioned a sense of rawness in the throat and slight colic. The dose was daily increased until, by the ninth day, one drop was taken, which produced salivation and colic; as the quantity was still augmented thin stools were produced, with slight headache, oppression and debility. The latter phenomena became more distinct as the experiment proceeded. In a case of very chronic articular rheumatism the following effects

of the bromide. This organ, even when immersed in a solution of the salt, will continue to pulsate for more than an hour; and when an animal is poisoned by the bromide, the death of the heart does not occur until after that of the nervous centres and of the voluntary muscles; indeed the heart continues to act for half an hour, an hour, two hours, and even longer, and may be the very last organ to give signs of life." (*Thèse;* Paris, 1868.) These conclusions are in direct contradiction of those of Eulenberg and Guttmann, who declare that the bromide exerts a powerful action on the heart (of the frog) when hypodermically injected, and that the living heart plunged into a solution of the salt, of one part to fifty, ceases to act in five minutes; but they agree with those of Damourette and Pelvet described in the text. The experiments of Laborde (also made upon frogs) agree in their results with those of Saison, showing that the movements of the heart continue long after the apparent death of the animal. (*Archives de Physiologie*, i. 420.) Dr. Purser's experiments would seem to help to explain these discrepancies. He found that in frogs bromide of potassium first destroys reflex action, then sensation, and then voluntary motion. "The effect of the drug upon the heart varies: If the dose be large and injected in the neighborhood of the thorax, the heart speedily comes to rest in diastole; but if the dose be smaller or injected at a distance from the chest, the heart will continue to beat for hours after movement of every other kind is at an end." (*Dublin Quart. Journ.*, May, 1869, p. 321.) Yet we have subsequently (*Practitioner*, Dec. 1869, p. 350) the statement of Dr. Nunneley founded on experiments, that "the rapid abolition of the heart's functions is remarkable;" and further that "when the heart is immersed in a solution of the bromide, the ventricle appears shrunken, and soon ceases to beat." The experiments of Schouten led him to conclude that this substance acts as a direct sedative upon the heart when it is injected into the blood; that, otherwise administered, small doses increase the frequency of the pulse and only large ones reduce it; and that one factor, at least, in the reduction of the pulse is a diminished amount of nutritive activity. (*Arch. der Heilkunde*, xii. 97.) Finally, it must be mentioned in this place, that several of the above-named experimenters, concluded that in whatever manner bromide of potassium operates it does so in virtue of the potassium it contains. This was the judgment of Eulenberg and Guttmann, and of several others. "Everywhere," says Professor Binz, "it is the potassium, and the potassium alone, which encounters us with the striking phenomena of depression of the nerves and muscles." (*Practitioner*, xii. 1.) This extraordinary opinion forms an appropriate conclusion to the series of contradictions of which a summary has been given, and which, while they illustrate the difficulty of arriving at truth even by experiments of which the conditions can be regulated at will, tend to diminish our surprise that the apparent action of medicines in disease should often be so uncertain and precarious.

were observed by Fournet.[1] When the dose was ten drops the patient experienced, a quarter of an hour after taking it, gastric oppression, nausea, eructation, colic, and borborygmi. An hour later he felt lancinating and compressive pains in the arms, which, however, were of short duration. Every day the same effects were produced anew. A burning or smarting sensation felt in the bowels increased with the dose and seemed to extend to the several portions of the intestine successively. When the dose reached forty-five drops the burning and acrid sensation was for a few minutes so severe that the features and limbs of the patient were momentarily convulsed. It was followed by nausea and violent retching. These effects were only of a few minutes' duration; and they were not followed by gastric oppression or heat. The appetite and digestion remained unimpaired, or rather were improved, as well as the flesh and general condition.

There is only one case recorded of poisoning by bromine. A daguerreotypist, at Williamsburgh, N. Y., took an ounce of bromine with suicidal intent. The immediate symptoms were spasm of the muscles of deglutition and respiration, with dyspnœa. Then followed intense heat in the stomach, great anxiety, restlessness, and trembling of the hands. The pulse was rapid and tense, and the breathing hurried and rattling. The stomach was empty at the time of taking the bromine. There was no nausea or vomiting except what was excited by emetic remedies. The skin gradually became cold and clammy; mucus flowed freely from the nostrils, and saliva from the mouth; there was great and distressing agitation; the skin in many parts was bluish; the countenance haggard and the eyes sunken. The pain in the abdomen moved gradually lower down. There was no loss of consciousness whatever. Death by collapse took place seven hours and a half after the poison had been swallowed. The mucous membrane of the stomach was found highly injected, and softened, and ecchymosed in spots, and was covered with a black deposit resembling coarse tanned leather. Similar appearances were presented by the duodenum. The peritoneum was highly injected in its upper half, and tinged of a reddish-yellow.[2]

Bromide of potassium was administered by M. Puche in daily quantities gradually increased from thirty to ninety grains, and which afterwards reached a maximum of three hundred grains. The first effect observed was headache with mental confusion, and a certain appearance of intoxication with impaired sight and hearing such as frequently occur in typhoid fever. At the same time the patient manifested some debility of the lower extremities, and his step was tremulous and ill-assured. This phenomenon was probably due to the impaired sensibility of the limbs, which was so decided that pinching and even burning the skin did not occasion pain. It was, however, unusual, and produced only by excessive doses of the medicine. Much more commonly, and indeed con-

[1] Bull. de Thérap., xiv. 88.
[2] SNELL, New York Journ. of Med., N. S. v. 170; 340.

stantly, the sensibility of the mouth and fa
paired, for their reflex actions were not exc
a similar insensibility sometimes affected t
In general, also, the genito-urinary organs
tion, and men of vigorous constitution, acc
tions of the penis, found that they ceased
cine, and for several days, even, after its use

Numerous cases of what may be regarded a
effects of this medicine, have been published,
may be cited: A man affected with ulcerat
bromide of potassium internally and by mean
the patient's complexion became of a dirty
hollow eyes, a strange fixed look, a face with
rable emaciation, tottering limbs, trembling
cachectic state. Gradually the appetite wa
the hairy scalp supervened, especially at ni
daily diminished, and the trembling increas
as these symptoms of *bromism* developed th
the throat was relieved. In two months the
ally the patient recovered.[2] In a case of epil
of twenty-two, increasingly large doses of t
for the space of a year. The patient becan
was yellowish, and her face covered with a
gastralgia, and was harassed with a dry cou
throat. Finally she died, delirious and oppre
a small, frequent pulse, and acute abdomi
cases reported by Vulpian, the medicine occ
tration, with involuntary fæcal discharges, w
This result was prevented by the withdrawa

The physiological action of bromide of pota
by many competent physicians, among wh
Garrod, Bartholow, Sée, Gubler, and Voisi
the last-named author are reproduced here
identity with those established ten years
which we have already quoted. "The phys
mide of potassium are these: the peculiar
the breath, redness of the soft palate and an i
secretion of saliva; a diminution and then
of reflex sensibility of the palate, the root
epiglottis, although the tactile sensibility an
parts remain unimpaired;[5] frequently a cra
constipation, some diuresis, sedation of the ge
tion and retardation of the menstrual flow;
catarrh; a general heaviness or inertness,

[1] Trousseau and Pidoux, Thérap., 5ème éd., i. 27
[2] Br. and For. Med.-Chir. Rev., Oct. 1866, p. 535.
[3] Annuaire de Thérap., 1869, p. 213. [4] Bull.
[5] In his work on Inhalation in Diseases of the Respi
that, although he had given the medicine to many patien
ing influence on the nervous system, he had never m
diminishing the irritability of the pharynx!

clearness of the intellect; a sedative action on the excito-motor function of the spinal marrow, and an impairment of general sensibility; the memory, especially for words, is enfeebled;[1] eruptions of acne frequently appear upon the skin,[2] which acquires a muddy or bronzed aspect; the muscles are enfeebled, and the gait is often unsteady or tottering; and frequently there is loss of flesh."[3] Bromide of potassium is eliminated with the urine, and the saliva, perhaps also by the skin.[4] All of these symptoms, without exception, appear to be attributable to the power possessed by the medicine of restraining the capillary circulation, of the nervous centres chiefly, but also of the other organs. Thus, for example, its anaphrodisiac operation may depend upon its preventing the due amount of blood from circulating in the spinal cord, and from filling the erectile tissue of the generative organs. Indeed, among the diseases for which this medicine is vaunted, there are very few whose improvement under its use cannot be explained by its power of diminishing the amount of blood, and the activity of the nervous element, in the affected part. By these it promotes sleep, prevents convulsion and spasm, palliates pain, and counteracts the element hyperæmia in all inflammations. It is evident, therefore, that its proper position in a classified Materia Medica, is rather with nervo-sanguine sedatives, than among the medicines of that class with which we have for the present associated it.

[1] Dr. J. Lockhart Clarke (*Brit. and For. Med.-Chir. Rev.*, Oct. 1870) noticed, as the direct effect of full doses of the medicine in some cases, a temporary but complete loss of memory even in a non-epileptic patient. In an epileptic he observed confusion of mind, and the substitution in writing or speaking of one word for another, as "contraction" for "subscription." So Dr. E. H. Clarke mentions a lady who, under the influence of the drug, "called a buckwheat cake a comb; and a comb a buckwheat cake." (*Bromide of Potassium, etc.*, 1872.) A lethargic condition of the mind, inattention, indifference, loss of memory, and dulness of comprehension, especially when observed in epileptic patients, are apt to mislead by giving the impression that the epilepsy is hastening towards its frequent termination in dementia.

[2] Voisin describes five different forms of cutaneous eruption occasioned by bromide of potassium. The most frequent is the acne-like eruption. It is most usual on the face and chest. A second form consists of oblong or roundish swellings on the lower extremities of a rose or cherry-red color, which afterwards become yellowish. A third form is in red, slightly elevated patches, of irregular form, which occur on the trunk and limbs, but not on the face. Boils, eczema, and pityriasis of the scalp complete the catalogue; but the only eruption of frequent occurrence is the one first mentioned. (*Journ. of Cutan. Med.*, iii. 312.) The acneiform eruption has been well described by Dr. Chomeley (*Trans. Clinical Soc.*, iii. 38.) The production of boils has been noticed by Levy and Frisbie (*Med. Record*, vi. 572), and more fully by Dr. S. W. Mitchell, who describes large and intractable ulcers as sometimes following. (*Amer. Journ. of Med. Sci.*, Oct. 1870, p. 440.)

[3] Bull. de Thérap., lxxi. 166. Compare NORTON, Glasgow Med. Journ., Feb. 1873, p. 239.

[4] The experiments of Dr. H. P. Bowditch led, also, to the conclusion that it is perhaps eliminated by the intestines. They showed that "it is sometimes decomposed in the system, and free bromine is eliminated with the breath;" and that "while passing out of the system its primary effect is to diminish all the secretions, except perhaps the urine, but secondarily hypersecretion may be induced." (*Boston Med. and Surg. Journ.*, Oct. 1868, p. 177.) The decomposition of the bromide in the system, and the elimination of its bromine with the breath, are rendered probable by the peculiar fetid odor of the breath, which sometimes renders the company of the patient in a close room intolerable.

Bromide of ammonium, according to Dr. Amory, "in *almost* every respect has the same action as bromide of potassium." Its primary operation is more stimulant, but is followed by sedation. Its more acrid and unpleasant taste renders it less eligible for internal administration than the other bromides, and requires it to be given in a smaller dose. Bromide of sodium and bromide of lithium have been used as substitutes for the potassium salt, but the former does not exert the same action upon animals, and Binz is disposed to deny it any important action at all. As to the bromide of lithium, which was introduced into the treatment of epilepsy by Dr. S. Weir Mitchell,[1] its taste is held to be less unpleasant than that of bromide of potassium, but more so than that of the sodium salt, and its hypnotic power greater than that of its allied compounds. It also appeared to act efficiently in some cases of epilepsy in which bromide of potassium had failed, and to be efficient in smaller doses than the salt just named.

Uses.—The resemblance which *bromine* bears to iodine in many of its physical relations and its association with that substance in nature, led to its being originally employed in most of the affections for which iodine was reputed to be a remedy. Thus, in goitre, in scrofula, chronic cutaneous eruptions, and constitutional syphilis, the medicine was extensively used, and for a time enjoyed some reputation for success; but its inferiority to iodine, or its absolute inefficiency, caused it generally to be omitted from their ordinary treatment. Yet in some cases of enlargement of the salivary and *lymphatic glands*, of the *liver*, *spleen*, *ovaries*, and *uterus*, its power has been unequivocally displayed. Some of the earliest examples of its beneficial influence were cases of enlarged spleen or liver, not of malarial origin, which it cured in the hands of Dr. Robert Williams.[2] He administered bromide of potassium in doses of from three to ten grains several times a day. Cases of ascites of hepatic or splenic origin have been cured by the same medicine. Dr. Gibb claims that the bromide of ammonium is very efficacious in abating corpulency, and improving the health of persons in whom atheromatous degeneration of organs has commenced.[3] Dr. Simpson used bromide of potassium with success in several cases of *fibrous tumors of the uterus*.[4]

By far the larger number of cases of disease to the relief of which *bromide of potassium* has been beneficially applied, are to be found among the functional disorders of the nervous system, and among those especially in which hyperæmia of the central organs of this system is the immediate cause of the morbid phenomena. The most important of them will now be considered.

Sleeplessness.—In 1850, M. Rames described the following among the phenomena produced by bromide of potassium: "The face loses its wonted expression and the eye its brightness; the tongue articu-

[1] Am. Journ. of Med. Sci., Oct. 1870, p. 443.
[2] Elements of Medicine, 1836, p. 333.
[3] Lancet, Jan. 1863, p. 11.
[4] Obstetric Memoirs, etc, i. 117.

lates imperfectly, the patients feel benumbed. If they get out of bed they return to it as soon as possible, and immediately *fall into a deep sleep*."[1] Dr. Garrod subsequently called attention to "the sleepiness or drowsiness" occasionally noticed when the medicine was given "in large medicinal doses."[2] Dr. Brown-Séquard first made use of it to relieve sleeplessness and restlessness accompanied by, and dependent upon, nervous excitement and irritability. The first cases of this description were published by Mr. Behrend.[3] In one, the patient had suffered much mental excitement consequent upon the dangerous illness of a near relative, and, in the other, a merchant was so harassed by the cares and anxieties of business as to lose his natural rest entirely. In both cases twenty-five grains of the bromide, taken three times a day, restored sleep, and with it health, to the exhausted patients. In an ingenious and well-known Essay of Dr. Hammond[4] the following passage occurs: "Among the more purely medicinal agents, bromide of potassium occupies the first place, and can almost always be used with advantage to diminish the amount of blood in the brain, and to allay any excitement of the nervous system that may be present in the sthenic form of insomnia. That the first named of these effects follows its use, I have recently ascertained by experiments upon living animals. I have administered it to dogs whose brains had been exposed to view by trephining the skull, and have invariably found it to lessen the quantity of blood circulating within the cranium, and to produce shrinking of the brain from this cause. Moreover, we have only to observe its effects upon the human subject to be convinced that this is one of the most important results of its employment. The flushed face, the throbbing of the carotids and temporals, the suffusion of the eyes, the feeling of fulness in the head, all disappear as if by magic under its use." Dr. J. C. Browne, medical superintendent of a large lunatic asylum, employed it in twelve cases, with the view of combating partial or complete wakefulness, and successfully in eight of them. In ten other cases, in which it was used for a different immediate purpose, improved sleep was observed.[5] The hypnotic operation of the medicine is also illustrated by the experience of Dr. Begbie, who remarks that "when opium and other narcotics have failed to procure sleep, or when they have succeeded only at the expense of sickness, vomiting, and headache, and other consequences, the bromide, free from all unpleasant and injurious effects, will often tranquillize and secure repose."[6] Two cases are reported by Dr. Percy, of New York,[7] the one of intense pharyngitis, the other of *herpes zoster*, in which the patients were prevented by their sufferings from sleeping. The medicine was administered in doses of sixty grains, repeated in the course of three or four hours. Dr. Hammond states that bromide of calcium, in the dose of from fifteen to thirty grains, is particularly useful in

[1] Bull. de Thérap., lxvii. 99.
[2] Times and Gaz., March, 1864, p. 276.
[3] Lancet, May, 1864, p. 607.
[4] On Wakefulness, 1866.
[5] Edinb. Med. Journ., x. 1097.
[6] Ibid., xii. 482.
[7] Amer. Med. Times, Aug. 1864, p. 76.

cases of delirium tremens, and in the insomnia resulting from intense mental labor or excitement.[1] For our own part, we have repeatedly made use of bromide of potassium for the purpose of calming restlessness, and procuring sleep in cases of wakefulness dependent upon nervous exhaustion from an excessive strain upon the mind or feelings, and have rarely been disappointed in the result. It is an admirable substitute for opiates in those cases of infantile wakefulness which depend more upon nervous erethism than upon pain or any local disease. In cases of moderate excitement a dose of ten grains taken an hour before bedtime will usually suffice; but when restlessness of body and agitation of mind are extreme, when the head is hot, and sleep seems really "frighted" from the sufferer's pillow, it may be necessary to administer twenty, thirty, or even forty grains to attain the object in view; and the action of the medicine should be promoted by cold ablutions of the head and a prolonged tepid foot-bath.

The tendency of bromide of potassium to promote sleep had come to be almost as familiar and as certain as that of opium. Prof. Binz surprised the medical world by assuring them that their observations were illusory, and that the bromide is either not a soporific at all or is so in virtue only of the indirect action of the potassium in its composition! "Are," he asks, "the numerous successful results really to be attributed to bromide of potassium as a nervine, and not to the natural decline of the morbid process, to psychical impressions, or to an improvement of nutrition by means of potassium, and other factors which mislead observation?"[2] Had this eminent professor regarded the clinical aspect of the question, he would perhaps have been less sceptical, and not forgotten that there are many ways, apparently, in which sleep may be produced, according to the state of the brain as to a diminished or an excessive supply of blood; according to the arterial or venous quality of that blood; according to idiosyncrasies, etc. In truth the clinical proof of the soporific power of the bromides is overwhelming, and is no more to be overthrown by adducing exceptional cases, than is the narcotic virtue of opium by the thousands of instances in which it causes persistent wakefulness instead of sleep. Undoubtedly, the special indication for its use is that already quoted from Dr. Brown-Séquard, "sleeplessness and restlessness accompanied by, and dependent upon, nervous excitement and debility," and under such conditions its operation is almost certainly soporific. It does not follow that this or any other form of insomnia may not be more beneficially treated by other medicines. Their superior virtues do not invalidate its power.

Neuralgia.—Among the numerous conditions which give rise to this affection, there is one, at least, which is often under the control of bromide of potassium, viz., a general state of nervous erethism induced by exhausting causes, and sometimes accompanied with a flushed face and cold hands and feet. We have treated cases of this

[1] New York Med. Journ., xiv. 594. [2] Practitioner, xii. 1.

nature successfully with the medicine, and others, having more or less of the same character, were relieved by it in the hands of Browne, Begbie, and Vigouroux. In several examples, reported by the last-named physician,[1] the patients were often affected with sombre melancholy, and presented in a greater or less degree other functional derangements, of the heart, the stomach, etc. It cannot be expected that the bromide should effect a radical cure, except in cases of a comparatively light grade and of recent origin; but it is often more useful as a palliative than any other medicines of the narcotic or antispasmodic class, and removes an embarrassing element in the way of the operation of remedies adapted to restore its natural vigor and balance to the nervous system. Anstie restricts still further the cases of neuralgia in which this medicine is available, to those in which the patients have a highly excitable and emotional nervous system due to ungratified sexual desires, cases which manifest "the *unconscious* struggles of the organism of a pure-minded person with the tyranny of a powerful and unsatisfied sexual system."[2] These cases are far from uncommon, but much less apt than the others to become the subject of medical treatment.

Insanity, in some of its forms, appears to be amenable to the influence of this medicine. Dr. Browne saw it efficacious in alleviating melancholia, simple, suicidal, akinetic, hypochondriacal, sexual, emotional, etc.; and Dr. Begbie, in two recent cases of violent maniacal excitement, saw a dose of thirty grains of the medicine, administered every second hour, reduce to quietness the restless subjects, and lay them down in sleep, of which they had for days been deprived. In the melancholic forms of the disease, attended, as they so often are, with obstinate wakefulness, its salutary influence is very distinct.

Delirium tremens, the disease of all others in which morbid vigilance is a prominent and characteristic symptom, the effects of this medicine are often very happy. Dr. Albert Day, of Boston, whose experience in its use extended to more than three hundred cases, pronounced it "the best remedy" when given in doses of from twenty to forty grains every four or five hours. When *mania à potu* has actually supervened, its results have been less marked and satisfactory, yet superior to those of any other drug now in use.[3]

Chorea is one of the diseases of the nervous system which, reasoning from analogy, might be expected to be most favorably influenced by this medicine. Several cases reported by Gubler[4] appear to prove it efficient, not only, but more promptly so than other remedies. In a very grave case, occurring in a pregnant woman, the cure was complete within a fortnight. In a case of rheumatic chorea of extraordinary violence Gallard effected a rapid and permanent cure by means of bromide of potassium.[5] A similar one, of which the reporter, Dr. Greenhow, says, "it was perhaps the most

[1] Bull. de Thérap., lxvii. 202.
[2] Neuralgia, p. 191.
[3] Methomania, Boston, 1867.
[4] Bull. de Thérap., lxvii. 52; lxviii. 178.
[5] Ibid., lxxvi. 565.

severe case of chorea which I have ever seen end in recovery," likewise began to amend from the very first dose of the medicine.[1] A case is reported by Dr. J. P. Hassler, of unilateral periodical chorea which occurred in a woman of fifty who had had a similar attack of several months' duration some years before. Under very moderate doses of bromide of potassium improvement began immediately, and in a few days the patient was restored to perfect health.[2]

Epilepsy.—In 1857, Sir Charles Locock stated that, having been struck by the reported effects of bromide of potassium administered as an anaphrodisiac, he used it with marked success in hysteria, and afterwards in hysterical epilepsy.[3] Dr. C. B. Radcliffe was one of the first who employed the medicine for the various forms of epilepsy. In 1858 he began to use it in almost all cases of epilepsy and epileptiform disorder, and from that time continually found fresh reasons for persevering in the practice. Indeed, he arrived at the conclusion that it is the remedy for epilepsy upon which most dependence can be placed.[4] It was soon afterwards tested by Drs. Hughlings Jackson, Ramskill, and Brown-Séquard,[5] who found that the dose originally proposed, of the medicine, was insufficient, and that it ought to be raised to twenty grains or more three times a day.[6] Its efficacy was soon attested by many observers of competent judgment, such as McDonnell,[7] Blache, Bazin, Demeurat,[8] and others. Dr. D. Williams, physician to the Northampton (Eng.) Lunatic Asylum, administered it in thirty-seven cases, and found that the aggregate number of fits in a period of six months before, and another of six months after, the use of the medicine was commenced, showed a diminution in the latter period of 306 for the male and 157 for the female patients.[9] M. Voisin, physician to the Bicêtre Asylum, employed this medicine in the treatment of twenty-four epileptics; in twelve of them the attacks were suspended, in six there was a very great improvement; ten were slightly benefited, and four experienced no advantage.[10] Dr. J. Russell Reynolds says: "Bromide of potassium is the one medicine which has, so far as I know, proved of real service in the treatment of epilepsy." Given in doses ranging from ten to thirty grains, three times daily, it has sometimes completely cured the patient, and the cure has been per-

[1] Trans. Clinical Soc., ii. 69.
[2] Am. Journ. of Med. Sci., April, 1868, p. 561.
[3] Lancet, May, 1857, p. 528.
[4] Lectures on Epilepsy, etc., Philadelphia, 1866, p. 201.
[5] A formula employed by the last-named physician will be found convenient. It is free from the objections to the simple solutions which readily undergo decomposition. ℞.—Bromide of ammonium, 40 grs.; bromide of potassium, 360 grs.; bicarbonate of potassium, 15 grs.; tincture of columbo, 1½ fl. oz.; water, 3 fl. oz.—M. Dose, a teaspoonful, diluted, before meals.
[6] Lancet, March, 1866, p. 251.
[7] Dublin Quart. Journ., Feb. 1864, p. 45.
[8] Bull. de Thérap., lxvii., lxviii., lxix.
[9] Edinb. Med. Journ., x. 1088.
[10] Bull. de Thérap., lxxi. 145. Several cases illustrating the efficacy of the medicine in epilepsy are reported by Dr. Horace Y. Evans, *Am. Journ. of Med. Sci.*, Jan. 1867, p. 133.

manent for years . . . in others it has arrested the attacks, but on the omission of the medicine the seizures have returned . . . in others again it has diminished the frequency and severity of the seizures but has not removed them altogether . . . in still another, but smaller, class of cases its influence has seemed to cease after a time . . . and finally in some cases it has been apparently without effect.[1] Dr. Echeverria has attempted to determine the value of the bromides of potassium by a study of 486 epileptics.[2] The salt proved powerless in 104 cases. The fits disappeared under the uninterrupted administration of the bromide of potassium in 112 cases for various periods from two to eight years. The sequel of the remaining cases is not related. In most of the cases the bromide was associated with other medicines, as stated in the following summary furnished by Dr. E. "The bromide of potassium is not a *specific* for epilepsy, but may contribute most efficiently to arrest the fits by suspending reflex excitability of the spinal cord. The benefits of the bromide of potassium increase and are better secured by administering it combined with conium, ergot, arsenic, and strychnia. Sixty grains is the average daily amount of bromide of potassium required in ordinary cases of epilepsy; but it is necessary to keep epileptics, at different intervals during the progress of their attacks, under the full physiological effects of the bromide, to suspend it until bromism is dispelled, and then to resume the salt again in ordinary doses. The bromide of potassium alone exerts little or no effect on the attacks of *petit mal*, unless associated with large doses of ergotine (gr. vj to gr. xvj) and conium. In epileptic insanity, or in any other form of insanity, the hypnotic and sedative properties of the bromide of potassium are usually unavailable when the salt is administered alone, a refreshing sleep and subsequent quietness being more readily obtained when the bromide is prescribed along with some narcotic, such as conium, cannabis indica, hyoscyamus, and still better with full doses of ergotine. The bromide of potassium should never be discontinued suddenly, even when the epileptic fits have not recurred for a long time, but the dose of the salt should be gradually decreased, and the treatment left off immediately when there is every indication of the complete eradication of the epileptic habit."

From comparative trials of the different bromides in epilepsy, Dr. Echeverria concludes that "the hypnotic and sedative properties of bromide of sodium and bromide of calcium appear to be weaker than those of the bromide of lithium, which in its turn is a less active sedative than bromide of potassium. The bromide of ammonium stimulates at first and then congests the brain, bringing about stupor in lower doses than any of the other three bromides here mentioned."

As to the power of bromide of potassium to cure epilepsy, our observation agrees perfectly with the statement of Dr. Anstie, that

[1] REYNOLDS' System of Med., i. 280.
[2] Philadelphia Med. Journ., Nov. and Dec. 1872.

neither Dr. Hughlings Jackson nor himself had observed "cases in which well-developed fits had been stopped completely, and had remained absent long after the discontinuance of the medicine.[1] Others appear to have been more fortunate, as we have heard asserted of themselves by more than one physician; and Dr. J. Warburton Begbie declares: "I have repeatedly seen cures, in the strictest sense of the word, result from its employment, after the failure moreover, in many cases, of other remedies.[2] When epilepsy is congenital or is caused by traumatic or other substantial lesions, this medicine, like all others, must be altogether inefficacious. The nearer the disease approaches to a purely functional disorder, the more amenable it is to treatment, and therefore the more so in proportion as it is of recent origin, and before those alterations of nutrition take place in the bloodvessels and in the substance of the nervous centres which render the disease inveterate. The more nearly epilepsy depends upon those innate or acquired conditions of the nervous centres which reveal themselves only by a morbid susceptibility to external impressions and reflex-irritations, the more curable it is by all of the remedies which have, from time to time, enjoyed the greatest vogue in its treatment, and among which, unless the evidences of its power are altogether deceptive, bromide of potassium stands preëminent.

Tetanus, even more usually than epilepsy, has its origin in reflex-irritation; such, indeed, are all cases of the traumatic form of the disease. Two cases, of which the favorable issue was unquestionably due to bromide of potassium, are reported by Dr. Briggs, of Nashville. In one of them the patient consumed in all more than a pound of the salt; and in the other forty grain doses every three hours were continued for a period of twenty days.[3] In the last few years (1868–74) a number of cases have been reported demonstrating unequivocally the virtues of the bromide in this disease. Seven cases, of which four were idiopathic and three traumatic, and of which the particulars are given, recovered. The medicine was exhibited in doses of from twenty to forty grains every two or three hours; and in several instances the relief following its administration was palpable. In addition to these, one physician, residing in Brazil, claims to have cured with the bromide twelve out of fourteen cases of (idiopathic?) tetanus.[4]

In *poisoning by strychnia* several cases of cure by bromide of potassium have been reported. In one it is stated that three grains of strychnia had been taken, the convulsions were very violent, and eighty grains of the bromide were directed to be given every half hour;[5] nevertheless, the patient recovered. In a second case five grains of strychnia were taken, and strychnism was fully de-

[1] Practitioner, xii. 21. [2] Ibid., p. 96.
[3] New York Med. Journ., Sept. 1867, p. 544.
[4] Am. Journ. of Med. Sci., Oct. 1868, p. 569; Lancet, Feb. 1869, p. 292; Edinb. Med. Journ., xiv. 993, xv. 261; Bull. de Thérap., lxxvii. 88, 428; Practitioner, iii. 134, 326; Boston Med. and Surg. Journ., July, 1869, p. 452.
[5] Am. Journ. of Med. Sci., Oct. 1870, p. 420.

veloped. Ninety grains of the bromide were given every half hour. In twenty minutes after the administration of the first dose, there was perceptible improvement. In two hours the patient could move his arms.[1] In a third case the first dose of the salt administered was half an ounce, and smaller doses were afterwards given at intervals of half an hour. In less than thirty minutes after the first dose, complete relaxation of the whole body occurred, and the patient recovered.[2]

These cases give a clinical confirmation of certain experiments on frogs. Paison injected into opposite limbs of the same animal strychnia and bromide of potassium. In the former case a tetanic condition was produced, in the latter relaxation. He then injected mixed solutions of the two agents, and found that the bromide diminished or neutralized the tetanizing action of the strychnia. And again having tetanized a frog he delayed the lethal issue by successive doses of the bromide. On one occasion he injected these two substances into opposite sides of a lizard; one side was paralyzed, and the other convulsed.[3]

Hysteria.—We have not observed, nor have we met with many published examples, of the efficacy of the remedy in this disease. Dr. J. C. Browne, however, found it eminently useful in several cases of local hysterical spasm. In two of them it relieved *œsophageal* spasm, long continued and severe; in a third it arrested violent oscillatory movements of the *eyelids;* and in a fourth it dispelled twitching of the *facial muscles*, almost choreic in character, but accompanied by globus. In all of these cases uterine disorder was present. The effects of the bromide were speedy, striking, and uniform.[4]

Infantile Convulsions.—Attacks of convulsion are, it is well known, extremely common among children during the first dentition, and indeed until the seventh year, from various causes, most of which may be classed as excentric irritation (gastric, intestinal, etc.); while others occur under the influence of that "fermentation" in the system which precedes the development of acute febrile diseases. Although their occurrence can rarely be foreseen in time to interpose an appropriate preventive, yet this is not always the case; for sometimes they recur repeatedly within a short space of time, and sometimes the same child is usually attacked by them whenever causes of either class referred to happen to be in operation. As the medicine is not in any way injurious, it should always be prescribed to prevent, if possible, an attack which it is painful to witness, and which sometimes may have serious consequences.

Puerperal convulsions are said, by Dr. Shoyer and Dr. J. B. Wood, to have yielded very promptly to this medicine given in doses of fifteen grains every two hours.[5] This result is in perfect accordance with those produced by the medicine in other nervous con-

[1] New York Med. Journ., xii. 297.
[2] Philada. Med. Times, i 316.
[3] Thèse, 1868.
[4] Edinb. Journ., x. 1087.
[5] Am. Journ. of Med. Sci., July, 1867, p. 276; and Oct. 1867, p. 566.

vulsive disorders having a reflex origin. A few cases have been reported of the successful use of the bromide, since the 3d edition of this work; but they are neither numerous enough, nor conclusive enough, to warrant a dependence on this remedy in so grave an affection.

Whooping-Cough.—In 1863, Dr. Harley, and also Dr. Gibb, reported favorably of the treatment of this disease by means of bromide of ammonium,[1] and their judgment was soon afterwards confirmed by Dr. Ritchie.[2] It appeared that the medicine possessed the power of eliminating the spasmodic element of the affection, and reducing it nearly, if not altogether, to the condition of a simple catarrh. During an epidemic of the disease in 1853, in Northampton Co., Pa., Dr. Traill Green employed this remedy with very remarkable success: "in some instances a single prescription was all that was necessary, the disease yielding in a few days."[3] Dr. De Beaufort employed bromide of potassium, internally, during an epidemic of the whooping-cough in France. He, too, observed a very striking improvement in the condition and comfort of the patients in consequence of the mitigation, and ultimately the cessation, of the paroxysms. They ceased after a treatment on an average of five days.[4]

In 1866, Dr. Helmke, of Jena, treated successfully, by the inhalation of an atomized solution of bromide of potassium, twenty-three children suffering from whooping-cough. The tendency to cough was strikingly diminished, the sputa became less tenacious, and the paroxysms less severe. The cure was accomplished in from eight days to three weeks. The strength of the solution employed was of two grains to the ounce of water.[5] Dr. Caldwell, of Brooklyn, refers to ten cases in which the affection was successfully treated by the inhalation of an atomized solution containing bromide of potassium and of ammonia, and fluid extract of belladonna. In all the cure was very rapid.[6]

Spasmodic asthma, of a very aggravated form, has been palliated in a very remarkable degree by this medicine, administered in large doses.[7] Sondahl reports cases of its prompt efficacy in this affection in children. In one of them he gave six grain doses of bromide of potassium every two hours to a child of fourteen months.[8] Dr. J. W. Begbie recommends its association with iodide of potassium, and arsenic.[9] Spasmodic *vomiting*, due to reflex irritation, has been alleviated by the same means; and one would suppose that the vomiting of pregnancy might be peculiarly amenable to its influence; but of its use under those circumstances we have no experience. Since this suggestion was made, cases have been published which prove it to have been well founded. Dr. Packard

[1] Lancet, Sept. 1863, pp. 363, 364.
[2] Edinb. Med. Journ., ix. 1095.
[3] Trans. Med. Soc. of Penna., 1864, p. 471.
[4] Bull. de Thérap., lxxii. 460.
[5] Ranking's Abs. (Am. ed.), xlvi. 263.
[6] Boston Med. and Surg. Journ., Apr. 1871, p. 259.
[7] Edinb. Med. Journ., xii. 485.
[8] Practitioner, ii. 121.
[9] Ibid., xii. 98.

employed the medicine successfully, giving it in doses of twenty grains every three hours;[1] and Gimbert arrested violent vomiting which threatened to exhaust the patient by administering nutritive enemata containing the medicine. The first day about 90 grains were used in this manner, and on the third day the quantity was increased to 150 grains. Thenceforward the vomiting ceased.[2] The medicine has also been used to palliate the *vomiting of phthisis.*[3] Nervous *palpitation of the heart*, and possibly even irregular action of the heart due to mitral obstruction, may be appeased by bromide of potassium. *Mercurial tremor* has been successfully treated by the same medicine, according to Dr. Bricheteau.[4] In a case reported by this physician the cure seems to have depended upon the sedative action of the bromide, and not upon its power of causing the elimination of mercury from the system.

Sexual Excitement.—We have already noticed the sedative influence which bromide of potassium exercises upon the functions of the organs of generation even in health. This operation, which was first observed by Huette in 1850,[5] and has been repeatedly witnessed by other observers, has been very usefully applied in numerous cases where erections or genital excitement have been prejudicial to health. In 1851, Thielmann employed it to prevent chordee, during the treatment of gonorrhœa, as well as nocturnal pollutions depending upon other causes. He not only administered the medicine internally, but applied a solution of it on compresses to the penis, enveloping the organ with oiled silk.[6] In 1856, Binet published several examples of *seminal emission* of long standing, in which the losses were entirely controlled by the use of the bromide.[7] Dr. J. C. Browne cites the case of a gentleman who had experimented with the medicine in his own person, and who declared that it not only lowered animal desire, but produced a feeling of disgust for all sexual ideas.[8] Dr. Hargis reports the case of a married man who was affected with persistent *priapism*, independently of all local or general disease. On two occasions the erections which were very painful were relaxed by bromide of potassium given every two hours in doses of fifteen grains.[9] The cases of this description in which we have employed the bromide of potassium are chiefly nocturnal pollutions occurring in young men of chaste life and sedentary habits, or in those who had been more or less addicted to self-abuse. In all such it is incomparably superior to dulcamara, belladonna, camphor, nitre, digitalis, and other nervo-vascular sedatives. It is not less potent in those sad instances of hysteroidal excitement which verge on nymphomania; and we have seen it temporarily beneficial in the case of a married gentleman of culture and good morals, whose sexual instincts were for so

[1] Am. Journ. of Med. Sci., July, 1868, p. 133.
[2] Bull. de Thérap., lxxxi. 461.
[3] Ibid., lxxvi. 136.
[4] Ibid., lxx. 371.
[5] Ibid., xxxix. 37.
[6] Ibid., xlvi. 327.
[7] Ibid., liv. 39.
[8] Edinb. Journ., loc. cit.
[9] Bost. Med. and Surg. Journ., Oct. 1869, p. 234.

long a time, and so extravagantly, excited, as to render probable the existence of some central cerebro-spinal lesion. In all of these affections small doses of the medicine are unavailing. Not less than twenty grains three times a day, will exert any control over excessive sexual propensities, even in adolescents; nor can its effects be expected to be permanent, unless advantage is taken of the improvement it occasions to invigorate the system by the combined resources of food, exercise, and proper habits of living.

Various Diseases.—The internal applications of bromide of potassium which have now been considered comprise all which have, at present, the support of sufficient medical evidence; and, it will be observed, they all relate to diseases of the nervous system. Some other affections, however, are reputed to have been cured by this medicine. Dr. Begbie assures us that it "has certainly stript *cholera* of some of its terrors,"[1] and "when administered early it has a decided power in arresting its fatal progress." These statements, which rest on a very brief and limited observation, and on an unfounded hypothesis of the nature of cholera, do not appear to have met with confirmation in any quarter. The same physician reports the permanent improvement, if not cure, of a case of *diabetes* under the use of this medicine in doses of twenty grains three times a day. In the *incontinence of urine* of young children it has, according to Dr. J. W. Begbie, answered even when belladonna failed. Dr. Austin Flint considered it of use in several cases of *diabetes*. In sick *headache* it has been recommended for the prompt and certain relief of the paroxysm. A case of *tubercular meningitis* in a lad, nineteen years of age, is said to have been cured by the administration of bromide of potassium in daily doses of from thirty to forty-five grains.[2] Dr. Brunton has reported three cases of *acute hydrocephalus* which seem to have been cured by small but very frequent doses of the medicine.[3] This case, like the preceding one, appears to be, so far, the only one of its kind. The bromide is further alleged to have cured a case of quotidian *intermittent fever*, after the failure of large and repeated doses of quinia.[4] It has also been used in *rheumatism*, for *rattlesnake's bite*, etc. Dr. Da Costa has called attention to its power of mitigating or preventing the nauseant and depressing effects which in some persons follow the administration of opiates. For this purpose it should be given in doses of from twenty to forty grains an hour or two before the administration of the opiate.[5]

Local Application.—The introduction of *laryngoscopy* rendered desirable the discovery of some agent capable of preventing those muscular movements of the pharynx and the adjacent organs which always tend to embarrass the operation, and sometimes to render it impossible. The bromide of potassium used in a gargle is a very efficient means of overcoming the obstacle which has

[1] Loc. sup. cit., and Lancet, Dec. 1866, p. 665.
[2] Bull. de Thérap., lxviii. 473.
[3] Glasgow Med. Journ., v. 27.
[4] Begbie, loc. cit.
[5] Am. Journ. of Med. Sci., April, 1871, p. 359.

been mentioned, and also of diminishing the difficulties and dangers of deglutition in cases of *ulcerated larynx*, through its power of lessening reflex excitability, and not, as has generally been supposed, by rendering the fauces insensible either to tactile impressions or to pain. The same quality of the medicine has been successfully invoked to remove *irritability of the urethra*, when it was so great as to interfere with the cure of a stricture by dilatation.[1] A collyrium of bromide of potassium has been employed to relieve *photophobia* with an alleged degree of success, which in view of the known action of the medicine, is extremely improbable.

Attention was first attracted to bromine as an application in *hospital gangrene* by Dr. M. Goldsmith, Surgeon U. S. V., and for a time it was supposed to be a very efficient application;[2] but more extensive observation has not sustained the original conclusions. It was proved, indeed, to be a very excellent antiseptic; but its power of arresting the destruction of tissue was not demonstrated, and the ulcers to which it was applied were sometimes found to be more intractable than others subjected to a different method of treatment.

Mr. Osborne claims to have caused, in several cases, the absorption of tumors of the breast by the constant application of a lotion of bromide of potassium in vinegar (ʒij to f℥vj).[3]

Administration.—Bromine is now never administered internally, because the bromide of potassium is more convenient and agreeable. The dose of this salt is from *three to thirty grains or more*, and may be repeated, if necessary, several times a day. The dose of the bromide of ammonium should not exceed twenty grains, and it should be well diluted; of bromide of sodium the dose is not less than that of the bromide of potassium; and of bromide of lithium about the same.

OLEUM MORRHUÆ.—Cod-Liver Oil.

Description.—Cod-liver oil is obtained from the livers of several species of *Gadus*, but especially of *G. morrhua*, or common cod, a fish that abounds near the coast of America in northern latitudes. Three varieties of the oil are found in commerce, the *pale*, the *light brown*, and the *dark brown*. The first named is procured from the fresh livers of the fish, sometimes by simple dripping, but more generally by maceration and a moderate degree of heat. In this country the livers are first reduced to a pultaceous mass by boiling with water, or by being inclosed in a metallic cylinder surrounded with steam. Afterwards, upon standing, the oil separates, floats upon the surface, and is removed. In England, after subjecting the sliced livers to a temperature of 180° F., the oil which drains

[1] Bull. de Thérap., lxvii. 102; London Hosp. Reports, ii. 344.
[2] Am. Med. Times, vi. 250.
[3] Times and Gaz., April, 1870, p. 412.

away is exposed to a temperature of 50° F., in order to congeal the bulk of the margarine, which is then removed, and the oil carefully bottled. Its color is a golden yellow, it has a peculiar but not offensive smell, and its taste is fishy. *Light brown* cod-liver oil only differs from the first-named in having a somewhat deeper color, a stronger smell, and an acrid or bitter as well as a fishy taste, qualities which are probably due to its being procured from livers which, although not putrid, are still not perfectly fresh. The *dark brown* oil is prepared by heat from partially decomposed livers; it is less transparent than the other varieties, has an offensive empyreumatic smell, and a bitter and acrid taste.

Besides the ordinary constituents of animal oils, such as oleic and margaric acid and glycerin, cod-liver oil contains a great variety of substances in very minute proportions, particularly the constituents of bile, and chlorine, bromine, and iodine. Of the last it is said that there exists less than four one-hundredths of a grain of iodine in every hundred grains of the oil.

It may be distinguished from other oils by placing a small quantity of it upon a white surface, as that of a plate, and letting fall upon its centre two or three drops of sulphuric acid, which will instantly occasion a number of radiating currents of a delicate and beautiful lilac hue. This peculiarity is ascribed to the bile which is contained in the oil. As Winckler has shown, by the addition of ammonia, a peculiar volatile principle is developed, called *propylamin*, which has a strong, pungent odor, recalling that of herring pickle. This effect is produced in no other officinal fatty oil.

History.—Pliny mentions the fat of fishes among remedies used for diseases of the skin.[1] From time immemorial cod-liver oil has been used in Westphalia as a popular remedy for gout and rheumatism, and in the Highlands of Scotland for rickets and scrofula.[2] In 1778, Günther, of Cologne, saw a large number of persons affected with chronic rheumatism resort to a tannery near Eberfeld to obtain cod-liver oil, which they believed would cure them.[3] In 1782, as we learn from Percival, nearly a hogshead of the oil was annually consumed at the hospital of Manchester, for the cure of chronic rheumatism, sciatica of long standing, premature decrepitude, etc. Its internal administration at the institution is said to have been accidental in the first instance; but was attended with so much benefit that very soon, Dr. Kay, a physician to the Infirmary, was led to employ it generally in cases of chronic rheumatism.[4] It is remarkable that Mr. Darbey, the house surgeon, in a letter to Dr. Percival, should have ranked this medicine next to bark, opium, and mercury, and that half a century should have been required to bring the medical world to his opinion. Bardsley, in 1807, partially confirmed the judgment of Percival and his associates; but, from that time, little was heard of cod-liver oil until 1822, when Schenck,

[1] Hist. Nat, lib. xxxii. chap. xxvii. [2] RICHTER, Ausfür. Arzneim., i. 236.
[3] TAUFFLIEB, from HUFELAND's Journ., 1824.
[4] PERCIVAL's Essays, ii. 354.

of Siegen, published an account of his having cured sixteen cases of chronic rheumatism by its means. Four years later, he added twenty other cases to the number, besides several of scrofulous disease.[1] The success of the remedy in the practice of many German physicians was made known[2] in France in 1837 by Taufflieb,[3] Riester,[4] Carron du Villards,[5] who also recommended it as a topical remedy for ulcers of the cornea,[6] by Gouzée[7] and others. In England, Dr. J. H. Bennett, who had become acquainted with the remedy in Germany, first drew attention to it by the publication of a treatise,[8] which drew upon him a grave reproof for expending so much enthusiasm upon a subject which, in the opinion of the reviewer, did not call for any at all.[9] Time, however, did justice to the correctness of his conclusions, for in 1853 we learn from Dr. Theophilus Thompson, one of the physicians to the London Hospital for Consumption and Diseases of the Chest, that *six hundred gallons* of the oil were annually used in that institution.[10]

Action of the Oil. *On Nutrition.*—Dr. Pollock has contributed some very interesting information in regard to the influence of cod-liver oil upon the fattening of *animals*, particularly pigs, bullocks, and sheep. In all there seemed to be a decided limit to the quantity which could be digested. Pigs consumed from one to two ounces *per diem ;* sheep, one ounce; and bullocks, from three to nine ounces. If more was taken, it invariably produced derangement of the digestion, and gave the fat a yellow appearance, and a fishy taste.[11] Klencke shaved some young dogs, and rubbed them with cod-liver oil twice daily for three weeks. At the end of this period, they were in as good condition as dogs to whom oil had been internally administered; their bile was found as rich in fat, and their chyle equally charged with corpuscles without nuclei. Similar changes were observed in the bile and chyle of a cat bathed twice a day for some time in the same liquid, and some oil was discovered in the urine of the animal, proving, it was supposed, its free absorption by the skin.[12]

The fattening influence of the oil on man is too familiar to need particular illustration in this place. It was first noticed by Bardsley. Simon, and also Thomson, have shown that under the use of the oil the proportion of red globules in the blood is materially increased.[13] These changes in the blood are most conspicuous during the treatment of phthisis, and will be alluded to more particularly in the sequel. It would appear probable that the continued use of the oil may sometimes predispose to local parenchymatous

[1] RICHTER, op. cit.
[2] Die Neue Arzneimittel, p. 508.
[3] Gaz. Méd., v. 502.
[4] Journal des Progrès, 1830, ii. 182.
[5] Bull. de Thérap., 1834, vi. 266.
[6] Bull. de l'Acad., i. 459.
[7] Bull. de Thérap., xiv. 279.
[8] Treatise on the Oleum Jecoris Aselli, or Cod-liver Oil, as a Therapeutic Agent in Certain Forms of Gout, Rheumatism, and Scrofula, London, 1841.
[9] Brit. and For. Med. Rev., Jan. 1842, p 197.
[10] Clinical Lect. on Pulmonary Consumption (Am. ed.), p. 93.
[11] Lancet, Nov. 1853, p. 435.
[12] THOMPSON, op. cit., p. 100.
[13] Brit. and For. Med.-Chir. Rev., Jan. 1856, p. 249.

congestions. Dr. Benson found a congested and consolidated condition of the lung unusually frequent in consumptive patients treated by its means,[1] and although Dr. Bennett says he never knew it to induce pneumonia, or fatty disease of the liver or kidneys, however long continued,[2] there are some experiments on healthy animals that countenance the original statement. Thus, Gluge and Thiernesse produced pneumonia artificially in certain animals by feeding them exclusively on cod-liver oil. The lesions found were hepatization of the lungs, and an accumulation of fatty fluid in the pulmonary parenchyma, the liver, the kidneys, and the blood.[3]

The action of the oil upon the function of *digestion* is often marked. It is sometimes laxative, but, if the bowels are sound, it more frequently constipates. When it exerts a favorable influence, the appetite and digestion usually improve. It sometimes, after having been taken for a considerable period, impairs the appetite, renders the tongue foul, excites heartburn, pain in the epigastrium, and rancid eructations, and may even produce vomiting. These effects are common to all oily substances. Dr. Russell observed that the people of Aleppo, who consume large quantities of olive oil, are very prone to "fevers and infarctions of the lungs." (*Percival.*) It was early remarked by Mr. Darbey that these qualities of cod-liver oil must necessarily restrict its use very much.

This oil manifests no direct influence on the *circulation* more than a similar quantity of other nutritious food would do. Percival noticed that in persons of an irritable habit the pulse is sometimes accelerated by it, and a glow of warmth diffuses itself over all the body. It appears rather to promote perspiration. No doubt it increases the solid constituents of the blood, and the mass of that fluid also. It has been said to be a frequent cause of hæmoptysis, but, as it is administered chiefly in tuberculous consumption, a disease of which that symptom is an incident, the question is evidently one not easy to be solved. It has already been referred to in connection with the alleged congestion of the lung produced by cod-liver oil. Taufflieb, however, insists upon the reality of the plethoric, congestive, and even inflammatory phenomena sometimes developed by cod-liver oil, while he admits that they occur most frequently when the oil is administered for pulmonary affections. Nor is the opinion unreasonable. The lungs in phthisis are, owing to their physical condition, peculiarly liable to intercurrent inflammation, and if, from any cause, a tendency to such an accident exists, it must necessarily be increased by the use of such a powerful stimulant to nutrition as the one in question. Dr. Theophilus Thompson has shown, by analyses of the blood of tuberculous patients, some of whom were treated with cod-liver oil, and others without it, that in the former a very large increase takes place in the proportion of red corpuscles in the blood.[4] It may, therefore,

[1] BRAITHWAITE'S Retros. (Am. ed.), 1850, xxi. 356.
[2] On Pulmonary Tuberculosis. p. 64.
[3] TAUFFLIER, op. cit., p. 74; and Gaz. Méd. de Paris, 1844, p. 718.
[4] Lancet, Nov. 1858, p. 552.

become a question whether it is always prudent to administer cod-liver oil in phthisis, without some precaution to guard against plethora and the hæmoptysis to which the medicine may render tuberculous patients liable. Iron presents a similar inconvenience, and it does not possess the countervailing advantage of so directly contributing, as cod-liver oil does, to the production of fat, and thereby tending to restrict the waste of the nitrogenized tissues.

Bardsley, and, since his time, other observers, have noticed an itching of the skin, with prickling heat, and a papular eruption, from the internal use of the oil. The perspiration is generally increased, and a fishy odor exhales from the whole body. The *urine* is commonly augmented, and generally furnishes a lateritious deposit. In females, the *catamenial* flow is apt to be augmented, and when it has been suppressed by disease, is often re-established under the influence of the oil.

Modus Operandi.—From the preceding considerations, as well as from the effects of the medicine in disease, it may be inferred that cod-liver oil is essentially a fat-producing agent. To this quality it owes, in a great measure, its controlling power over scrofulous and phthisical diseases, the most prominent effect of which is to cause a wasting of the adipose and then of the muscular tissue. It may be stated, in confirmation of this view, that all tradesmen who are habitually in contact with fatty substances, *e. g.*, butchers, cooks, oil-men, tallow-chandlers, etc., are less liable than others to scrofula and phthisis. It is also well known that modes of treatment for phthisis have at various times been vaunted, which consisted chiefly in the use of oily substances, such as asses' milk, cream, butter, fat pork, buffalo marrow, etc. If cod-liver oil has been more efficient than these, it is because it contains principles in which they are deficient, particularly the constituents of the bile, and which facilitate its digestion, either by promoting the secretion of bile, or by otherwise favoring its own assimilation, as well as that of the nutritious food which is given in connection with it. Naumann has shown experimentally that fat obtained from the liver is from four to seven times more readily absorbed by the skin than other fat. It is also much more easily assimilated by the intestines, and much more oxidizable. These facts serve to explain the comparatively easy digestibility of cod-liver oil.

Remedial Employment. *Chronic Rheumatism.*—In Germany, where cod-liver oil was first used extensively for this disease, a large number of the most eminent physicians place it in the first rank as an anti-rheumatic medicine. This estimate of its value, says De Jongh, "is not founded upon mere assertion, but is established by innumerable cases of undoubted cure, in which patients had suffered many years from rheumatic disease, and after, in vain, trying every other means, had eventually been restored by cod-liver oil." But, on examining the subject, this estimate is hardly sustained. As long ago as the time of Bardsley, we find that this physician spoke of cod-liver oil as a medicine of "efficacious but limited powers."

chiefly in chronic rheumatism with rigidity of the joints.[1] Even earlier, Darbey described particularly the cases to which it is adapted. He says: "Men and women, advanced in years, whose fibres may be supposed to have acquired a degree of rigidity, find surprising effects from the oil. Some who have been cripples for many years, and not able to move from their seats, have, after a few weeks' use of it, been able to go with the assistance of a stick; and, by a longer continuance, have enjoyed the pleasing satisfaction of being restored to the natural use of their limbs, which, for a long time before, had been a burden to them."[2] Taufflieb, also, says that the operation of the remedy is most beneficial when the constitution of the patient is impaired by protracted suffering, slow fever, and insufficient nourishment. Dr. Fuller, moreover, is of opinion that under ordinary circumstances its efficacy is questionable, and he reserves its use for cases in which a cachectic condition predominates.[3] These conclusions are, more or less definitely, the same in substance with those which have been reached by Dr. Müller, of Mulhouse, and which are of sufficient importance to be quoted here. He thus describes the two forms of rheumatic disease which the medicine is adapted to cure: 1st. Musculo-fibrous rheumatism arising in a state of abject poverty, and produced by crowded dwellings, insufficient air and light, an originally feeble or impaired constitution, a scrofulous constitution, and inherited proclivity to the disease. This form of rheumatism begins with dull pains in the limbs, extending gradually to the spine, and as high as the neck, producing stiffness and more or less permanent rigidity of the muscles of the trunk and limbs. It presents no inflammatory phenomena, but is accompanied by œdematous swelling without redness, and may terminate in paralysis. 2d. Fibrous rheumatism, produced by a protracted residence in damp and cold localities, and differing from the first variety in being confined to the joints. It, however, gradually exhausts the strength, and impairs the nutrition of the patient. In these two forms only of rheumatism did Dr. Müller find the oil of service, and hence the results of his observation entirely confirm those which have already been cited. In other words, cod-liver oil is a remedy not for rheumatism as such, but for a cachectic state of body, which sometimes sustains and protracts indefinitely the rheumatic disorder. This view explains why, in such cases, the first effect of the remedy is to produce an exacerbation of the pain; it is only at a later period, when the oil has begun to improve nutrition, that it triumphs over the state of morbid sensibility by enabling the system to get rid of its cause.

Scrofula.—According to Brefeld, no other remedy for scrofula is comparable to cod-liver oil; but he at once lessens the force of his testimony by reckoning rachitis among the forms of scrofula, and the one in which the efficacy of the oil is most apparent. He states,

[1] Med. Reports, p. 20. [2] PERCIVAL's Essays, ii. 361.
[3] On Rheumatism, etc. (Am. ed.), p. 298.

however, and in this his experience accords with general observation, that the medicine is more valuable in affections of the internal than in those of the external lymphatic glands. Heineken and Kopp agree substantially in this estimate; and Bredow, while admitting that the oil is very useful as nutriment, insists that he has never been able to ascribe the radical cure of scrofula to its use.[1] So Phillips, while admitting that he has seen enlarged glands, sinuses, ulcers, lupus of the face, and caries all get better under its use, has yet generally found either that the stomach or the patience failed before the remedy had been carried far enough to produce any considerable amelioration.[2]

Seeing how various and uncertain are the opinions of physicians upon the general subject under consideration, we shall find it profitable to inquire what are the effects of cod-liver oil in the several forms of scrofula. But there is one remark which is applicable to them all. In proportion as the local disease affects a person who has been subjected to bad hygienic influences, and especially to the use of coarse and innutritious food, does the action of the oil appear to be prompt and decided. Where, on the other hand, it has become developed in spite of favorable external conditions of living, and particularly when, as often happens, the digestion is very feeble and imperfect, the oil is seldom tolerated, and rarely produces any good effect.[3]

In scrofulous enlargement of the parotid, thyroid, and submaxillary glands, and of those seated in the neck, axillæ, and groins, cod-liver oil is of little use. In such cases, when caries of the bones exists at the same time, it is not unusual to find the latter disease getting well under the use of the remedy, while the glandular affection remains unaffected. This result is strongly in contrast with what takes place under the administration of iodine, which causes the glandular enlargement to decline, but does not influence the caries. But when scrofulous abscess and ulceration have attacked the glands, and an indolent ulcer with excavated edges remains, or one extending under the skin and between the muscles, nothing promotes a cure so certainly as cod-liver oil. In such cases the patient is frequently anæmic, emaciated, nervous, and dyspeptic, but under the use of the remedy speedily recovers that tone of the system which is necessary to his cure. This curative power is signally manifested in healing cold abscesses after their evacuation; the serous is replaced by a purulent discharge, healthy granulations cover the indolent surface of the sore, and cicatrization ensues.

Cod-liver oil has been vaunted as almost a specific for *tabes mesenterica*. Brefeld and various other physicians have found it singularly successful in cases supposed to be of this nature. But when

[1] RIECKE, Die neuern Arzneimittel, p. 515.

[2] On Scrofula (Am. ed.), p. 258.

[3] The very singular statement is attributed to Segnitz, that when the oil is given to children predisposed to scrofula, the disease may be developed by its use; that in young children it may bring on atrophy, and that in such cases the teeth usually decay. (*De Jongh*, p. 104.)

we consider that enlargement of the mesenteric glands must be very great before it can be detected through the tumid abdomen which belongs to this affection, also that such enlargement is usually tuberculous, and, further, that a tumid abdomen is common among scrofulous, and especially rachitic, children, and often results from dropsy and is caused by enlargement of the liver, we cannot avoid entertaining some doubt respecting the reality of the alleged cures. Unquestionably the medicine has frequently converted the child of pale and emaciated features, shrunken limbs, and projecting abdomen, into one of comely look and fair proportions; but seldom, it is believed, when the detection of mesenteric tumors through the parietes of the abdomen has rendered their existence certain.

In *scrofulous ophthalmia*, particularly in granular inflammation of the conjunctiva, blepharitis, and ulceration of the cornea, cod-liver oil has been highly recommended, particularly when these affections were of long standing, and had not improved under a merely local treatment. But general experience has not fully confirmed the recommendation. Owing to the statement of Lombard, and other Swiss physicians, that such affections yield promptly to the remedy in question, Lebert made an extensive trial of it in cases of the same kind, but with unsatisfactory results. In some, it is true, a marked improvement took place slowly and gradually, but in nearly half of the whole number the medicine produced no sensible effect at all upon the course and symptoms of the disease.[1]

Caries, and Strumous Osteitis.—In all forms of idiopathic strumous caries, cod-liver oil is a most valuable remedy. This is a disease which seldom improves if abandoned to the resources of nature. The swelling, softening, and disintegration of the bony structure (although it is not due to the deposit and softening of tuberculous matter), the ulceration of contiguous soft parts, external abscess, and hectic fever, with marasmus, generally form the steps that lead to death. From 1824, when cod-liver oil began to be used as a remedy for this affection, a large number of cases of its cure have been recorded. Taufflcib reports twenty-one as having been treated by himself. In thirteen of them there was confirmed caries; in eight others, there was simple scrofulous swelling of the bone and periosteum without softening or ulceration. Of the first class, ten were cured; the remaining three who were not benefited, were of persons advanced in years. Of the second class, all recovered. The more chronic and torpid the disease, the more efficacious did the oil appear to be, and it always improved the general health before the local affection. Lebert gives a more qualified estimate of the success to be hoped for from this treatment. Indeed he declares that he found it fully successful in only one-third of the cases. It was most useful when caries attacked the epiphyses of the long bones, and less so in caries of the shafts of these, and of the flat bones. He is also of opinion that its efficacy in vertebral caries is still doubtful, and that there is no proof of its acting beneficially

[1] Maladies Scrofuleuses, p. 331.

in necrosis, or of its hastening the expulsion of sequestra. But a most important influence which it exerts, is to prevent new developments of scrofulous disease in other parts of the osseous system, by its salutary influence upon the blood and nutrition.[1]

Cod-liver oil has been employed with signal advantage in the treatment of white swelling and other forms of *chronic arthritis.* Lebert obtained such excellent results in these affections by its means that he is disposed to look upon its use as one of the most useful achievements of modern medicine. Taufflieb reports eighteen cases which came under his observation. In eight of them the hip-joint was the seat of disease. In most of these cases the improvement is stated to have been progressive and the recovery perfect. Lebert found it much more useful when the disease originated in the bone itself, than when it began in the synovial membrane. On the other hand, it appeared more successful in the cure of fistulæ and abscesses around joints, than in affections of the joints themselves. Among the latter, arthritis of the ankle-joint was most distinctly benefited, and the like affection of the hip-joint the least so. Lebert prescribed not more than two or three tablespoonfuls a day of the oil, but required it to be continued for many months, indeed for a year or even more.

Rachitis.—Physicians who have made use of cod-liver oil in this affection are unanimous in according to it extraordinary curative powers. Since the first publication upon the subject by Schenk in 1826, proofs of its efficacy have accumulated on every side. In France a knowledge of its virtues was obtained accidentally by Bretonneau, from a Dutch merchant, whose child was affected with rachitis. Soon afterwards the remedy was tried by Trousseau with unlooked for success, and by him its virtues were more widely published.[2] The cases in which he used it included children with imperfect ossification of the bones, enlargement of the cranium with persistence of the fontanelles, tardy or premature dentition, enlargement of the liver, and abdominal dropsy. Sometimes after four or five days of treatment, the pains in the limbs ceased, and at the end of a fortnight, bones which before were flexible, acquired a good degree of firmness. Sometimes, indeed, the treatment failed, either because the digestive organs did not become habituated to the oil, or because it could not be assimilated, or because it was impossible to make the little patients take it regularly. In softening of the bones occurring in adults, the oil sometimes produces a surprising cure.[3]

Diseases of the Skin.—The benefits of cod-liver-oil in cutaneous diseases appear to be confined chiefly to those which are engrafted upon a scrofulous or a cachectic state of the system. When an original inflammatory element prevails, the oil is worse than useless.

Lupus, which is eminently a disease of scrofulous origin, is, more

[1] Maladies Scrofuleuses, p. 546. [2] Journ. de Médecine, 1844, ii. 321.
[3] BEYLARD, Bull. de Thérap., xliv. 41.

perhaps than any other, curable by this medicine. Emery treated seventy-four persons affected with lupus, twenty-eight of whom are said to have been cured, while, of the remainder, those who continued under treatment were greatly benefited. When the medicine was fully tolerated, he prescribed it in doses which were gradually increased until they amounted to a pint or more of the oil in a day.[1] Dr. Terlinck, of Ghent, has described the case of a man in whom this disease occupied the sternum, neck, and left cheek. He commenced by taking half a pound a day of the oil, and gradually increased the dose until it reached three pounds a day. The treatment, which ended in a perfect cure, lasted six months, during which time two hundred and sixty-five pounds of cod-liver oil were taken.[2] The necessity of such enormous doses is far from being apparent, for an equally aggravated case with that just mentioned was cured by Mareska, with doses of two or three tablespoonfuls a day.[3] Dévergie, whose large experience entitles his opinion on the subject to respect, pronounced this medicine the most efficacious of all that are employed in the treatment of lupus, and believed that of itself, even, it is often competent to the cure, if given in the dose of from three to ten spoonfuls a day for a period of three, six, or more months. He, however, usually associated the oil with iodide of potassium and wine of gentian, prescribing at the same time sulphurous baths, good food, and regular active exercise. As long as the disease improved, no external application was made, but when it became stationary, the chloride of zinc caustic was resorted to, alone, or else was preceded by the local use of oil of cade every day, of a caustic solution of iodine every two days, or of cod-liver oil night and morning.[4] By this treatment, we are assured, the former and usual duration of the cure was abridged one-half.

Bennett, Guérard, Brefeld, and others, report the cure of *tinea favosa* by *cod-liver* oil, but it is probable that the term has been incorrectly applied by these writers to *impetigo* of the scalp, and *chronic eczema*. Favus requires a very different treatment for its radical cure, although this may often be hastened by the use of cod-liver oil and other strengthening medicines. The other affections mentioned may be advantageously treated by removing the crusts with a poultice, clipping the hair short, anointing the scalp with cod-liver oil, and directing an oil-skin cap to be constantly worn. Dr. Bennett states that by a method of this sort, the average duration of the cure of "tinea favosa" is about six weeks. Dr. David, of Canada, also found this remedy of service as a local application in *tinea capitis*, *psoriasis*, etc.,[5] by keeping the affected parts constantly saturated with the oil; and a precisely similar method is reported by Malmsten, of Stockholm, to have been successful.[6] Dr. Banks has published a case of congenital *ichthyosis* in a scrofulous child ten years of age, which was completely cured by

[1] Bull. de Thérap., xxxv. 373.
[2] Edinb. Month. Journ., Aug. 1852, p. 231.
[3] Abeille Méd., ix. 209.
[4] Maladies de la Peau, p. 579.
[5] Bull. de Thérap., xliv. 87.
[6] Times and Gaz., July, 1855, p. 8.

the use of the oil internally and externally;[1] and Dr. O'Conor states that he restored to health two cases of this affection by an external application of the remedy.[2]

Phthisis.—The first application, by a physician, of cod-liver oil to the cure of tubercular consumption appears to have been made by Kolkmann, in 1824. It was used by H. Richter, in 1835, after which its employment became general in Germany. To Dr. Bennett we are mainly indebted for its introduction into England and this country for the same purpose. In his Report of the results attending its first trial, it is stated that "individuals presenting emaciation, profuse sweats, constant cough and expectoration, as most prominent symptoms, with a degree of weakness that prevents their standing alone, after a few weeks' use of it are enabled to get up with ease, and walk about, with a visible improvement in their general health, and an increased amount of flesh." The moist, gurgling râles are exchanged for dry, blowing sounds, and sometimes all the physical signs of cavities disappear, leaving only slight dulness on percussion, and increased vocal resonance.[3] The same account, precisely, of its effects was soon afterwards given by Dr. C. J. B. Williams,[4] whose competence to testify in a case like the present, no one will deny. The power of the medicine in staying the demon of destruction, is, he remarks, sometimes marvellous. "We repeatedly find forms and degrees of disease that former experience has taught us to be utterly hopeless and speedily fatal, retarded, arrested, nay, sometimes even removed, and almost obliterated by various processes of restored health." At the same time Dr. W. refrained from pronouncing in regard to the permanence of the cure which was thus so happily obtained. The same year, in the First Report of the London Hospital for Consumption,[5] it is stated that in about eighteen per cent. of the cases treated the disease was arrested, in about sixty-three per cent. it was improved, and in nineteen per cent. it went on unchecked. It was now also observed that occasionally the weight increased without an amelioration of the symptoms, and also that sometimes relapse occurred followed by a rapid progress to a fatal issue. The larger experience of a series of years diminished somewhat the enthusiasm and confidence which the new remedy had originally inspired, and we find that in 1853, Dr. Bennett, himself, thus briefly states its value: "Its effects in phthisis are, to nourish the body, which increases in bulk and vigor; to check fresh exudations of tubercular matter; and to diminish the cough, expectoration, and perspiration."[6]

The great and enlightened experience of Dr. Walshe led him to conclusions which we now proceed to quote. The reader will observe, that while he concedes to the oil all of the nutrient quali-

[1] Dublin Quart. Journ., Aug. 1851, p. 80. [2] Lancet, Jan. 1856, p. 96.
[3] BENNETT on Cod-Liver Oil. Edinb. 1848.
[4] Lond. Journ. of Med., Jan. 1849, p. 1.
[5] Lond. Month. Journ., Nov. 1849, p. 239.
[6] The Pathology and Treatment of Pulmonary Tuberculosis, p. 64.

ties which have been claimed for it, he is not prepared to regard it in any sense a cure for tubercular consumption.

"1. That cod-liver oil more rapidly and effectually induces improvement in the general and local symptoms than any other known agent. 2. That its power of *curing* the disease is undetermined. 3. That the mean amount of permanency of the good effects of the oil is undetermined. 4. That it relatively produces more marked effects in the third than in the previous stages. 5. That it increases weight in favorable cases with singular speed, and out of all proportion with the actual quantity taken; that hence it must in some unknown way save waste, and render food more readily assimilable. 6. That it sometimes fails to increase weight. 7. That in the great majority of cases, where it fails to increase weight, it does little good in other ways. 8. That it does not relieve dyspnœa out of proportion with other symptoms. 9. That the effects traceable to the oil in the most favorable cases are: increase of weight, suspension of colliquative sweats, improved appetite, diminished cough and expectoration, cessation of sickness with cough, and gradual disappearance of active physical signs. 10. That in some cases it cannot be taken, either because it disagrees with the stomach, impairing the appetite (without itself absolutely nourishing), and causing nausea, or because it produces diarrhœa. 11. That in the former case it may be made palatable by association with a mineral acid; and in the latter prevented from affecting the bowels by combination with astringents. 12. That intra-thoracic inflammations and hæmoptysis are contraindications to its use, but only temporarily so. 13. Diarrhœa, if depending on chronic peritonitis, or secretive change, or small ulcerations in the ileum, is no contraindication to the use of the oil; even profuse diarrhœa caused by extensive ulceration of the large bowel, is not made worse by it. 14. That the beneficial operation of the oil diminishes, *cæteris paribus*, directly as the age of those using it increases. 15. That the effects of the oil are more strikingly beneficial when a small extent of lung is implicated to an advanced stage, than where a relatively large area is diseased in an incipient stage. 16. That where chronic pleurisy or chronic pneumonia exists on a large scale, the oil often fails to relieve the pectoral symptoms. 17. That it often disagrees, when the liver is enlarged, and probably fatty. 18. That weight may be increased by it, the cough and expectoration diminish, night-sweating cease, the strength which has been failing remain stationary, under the use of the oil, and yet the local disease be all the while advancing."[1] "Singular proof," says Dr. Walshe, "of the nutritive powers of the agent,"—and, we may add, of its inefficiency as a medicine.

This admirably exhaustive summary of the knowledge which is possessed of the subject to which it relates, confirmed, as it has

[1] A Practical Treatise on the Diseases of the Lungs, etc., 2d ed. Phil., 1860, p. 388. The passage quoted in the text is slightly abbreviated by the omission of several sentences of minor importance relatively to the present question.

been, by the conclusions of other competent observers,[1] shows a wide difference between the anticipations which were indulged respecting the virtues of cod-liver oil and the sober realities of experience. But enough remains to prove that among all the remedies that have been proposed for pulmonary consumption, none can be compared with this in efficacy. More than any other, it mitigates the symptoms of the disease, and delays its march; while in some cases it appears permanently to arrest the degeneration of deposits already existing, and to improve the nutrition so as to prevent the formation of new ones.

As the employment of cod-liver oil in phthisis is so general, both in England and in this country, it was to be expected that the influence of the medicine in postponing death would be visible in the bills of mortality. According to Dr. G. B. Wood, during the first years after its introduction a most striking difference was observed, and the number of deaths diminished surprisingly.[2] This result was anticipated by Dr. Walshe.[3]

In the foregoing remarks phthisis has been spoken of as if it were a disease which uniformly follows the same course. But it must not be forgotten that there are cases of acute tuberculization of the lungs, which terminate fatally in a few weeks, and that there are chronic cases in which the tuberculous deposit is limited, or occurs at long intervals in successive crops. In acute phthisis, cod-liver oil, like every other remedy, is totally unavailing. On the other hand, in that form which occurs in persons of a lymphatic temperament, and whose functions, especially those of nutrition and circulation, are feeble and sluggish, the greatest advantage may be hoped from a systematic use of the oil. But much will depend upon the extent of the disease. A cavity of moderate size,

[1] Dr. E. Smith, Lancet, Nov. 1857, p. 473.

[2] Trans. of the Coll. of Physicians of Philadelphia, March, 1854.

[3] Op. cit., p. 533. In Philadelphia, the ratio of the annual mortality from consumption to that from all causes, was as follows, beginning with 1836:—

1836, 1 : 7.3	1842, 1 : 7.7	1848, 1 : 8.	1854, 1 : 8.6
1837, 1 : 7.	1843, 1 : 7.7	1849, 1 : 10.	1855, 1 : 7.8
1838, 1 : 7.5	1844, 1 : 6.9	1850, 1 : 9.3	1856, 1 : 8.2
1839, 1 : 7.1	1845, 1 : 7.6	1851, 1 : 10.	1857, 1 : 7.
1840, 1 : 6.2	1846, 1 : 7.6	1852, 1 : 8.6	1858, 1 : 6.
1841, 1 : 7.2	1847, 1 : 8.3	1853, 1 : 6.9	

It will be seen that the ratio of mortality from consumption declined only from the year 1847, whereas the use of the cod-liver oil began five years before. It will also be observed that this ratio experienced the most marked declension in the year 1849, 1850, and 1851, after which it again rose, although the use of the oil probably became more general at the same time. The improvement in the ratio of mortality in the second decade, as compared with the first, is probably due to the rapid increase of the population by immigration from the country, and from beyond the seas. This increase is illustrated by the aggregate mortality from all causes, which in 1836 was 5448, and in 1856, had reached 12,334, and in 1858, was 10,697. During this period, a very large number of adolescents and adults was added to the population, and tended to diminish the proportion of those who, from innate or acquired debility, are the chosen victims of consumption. We suspect that the gold of California, which everywhere has fostered the growth of cities at the expense of the rural districts, is the real cause of the slightly diminished ratio of mortality from consumption during a portion of the ten years referred to.

confined to the upper lobe of one lung, is infinitely more curable than scanty but disseminated tuberculous deposits in both lungs. Probably the best among the demonstrable results of cod-liver oil are an arrest of the signs of progressive tuberculization, and the gradual contraction of pulmonary cavities.[1]

In other diseases, involving more or less deterioration of the nutritive function, cod-liver oil is often of signal service. *Chronic bronchitis* is one of these, whether it succeeds the acute affection and occupies both lungs, or whether it results from chronic pleuro-pneumonia, and is confined to a single lung. *Chronic pleurisy* itself, when debility hinders the absorption of the pleuritic effusion, may be sometimes benefited by this remedy conjoined with iron and a general tonic regimen. *Laryngismus stridulus*, depending upon a weak and irritable condition of the system,[2] and *diabetes*, are also said to have been cured by it.[3]

Dr. Anstie has called attention to the usefulness of cod-liver oil in the treatment of chronic convulsive diseases, viz., *paralysis agitans*, *simple epilepsy*, *mercurial tumor*, and *chorea*. The cases of these affections benefited by the treatment were those of persons of a very feeble constitution, or who had been reduced to a state of great debility by the predisposing causes of the disease that affected them. In other words, the oil cured them by virtue of its nutritive operation.[4] This oil has been recommended as a specific remedy for *night blindness* by Desponts.[5] We have tried it in some cases occurring in soldiers, but without avail.

Substitutes for Cod-liver Oil.—Dr. Radclyffe Hall, physician to the Hospital for Consumption at Torquay, used *neat's foot* oil as less apt to disagree with the stomach. It was more laxative than the cod oil.[6] Dr. Theophilus Thompson found that *cocoa-nut* oil increased the red corpuscles and the fibrin of the blood almost as much as cod oil.[7] Mr. Leared proposed the use of the *oleine* of cod-liver oil, supposing that the latter disagreed with the stomach, chiefly on account of the presence of margarin.[8]

Oil procured from the razor thorn-back, whale oil, almond, olive, and poppy oils, fat pork, and other highly carbonaceous substances, have been also used as substitutes for cod-liver oil, but with very partial and equivocal success.

Administration.—A great many formulæ have been devised for disguising the taste and smell of cod-liver oil. Not only do they seldom succeed in their intention, but they are too expensive for the exhibition of a medicine which must be taken so frequently and for so long a time. Iron rust water is an exception to this

[1] For illustrations of arrested phthisis the reader is referred to the cases published by QUAIN, Lancet (Am. ed.), 1851, pp. 31, 109, etc.; GREENHOW, ibid. (Eng. ed.), December, 1854, pp. 502, 542.
[2] Ed. Month. Journ., April, 1850.
[3] Lancet, Sept. 13, 1851.
[4] Times and Gaz., March, 1863, p. 330.
[5] Bull. de l'Acad., xxvii. 1016.
[6] Bull. de Thérap., xliii. 196.
[7] Brit. and For. Med.-Chir. Rev., Jan. 1856, p. 249.
[8] Times and Gaz., July, 1855, p. 58.

statement. Oil of bitter almonds has also been proposed as a disinfectant, but it must be cautiously employed. Percival mentioned, long ago, that people of the lower classes do not generally object to its taste. This is true to some extent, even now; and children often learn to take it readily. Percival suggested the addition of a little liquor potassæ and mint-water to each dose. Dr. A. Wallace recommends that it be shaken up with lime-water so as to form an emulsion.

The best of all the expedients for concealing the taste of this useful medicine is the one mentioned by Bardsley, viz., *table beer*.[1] A conical-shaped wineglass should be half filled with beer, ale, or porter, the oil poured upon its surface, and some froth of the liquor having been added, the whole should be quickly *tossed* down the throat. Wine, brandy, or whiskey, may also be used, but they are less eligible.

It has been proposed to mask the taste of the oil by forming it into a bolus with arrowroot, and swallowing the morsel in a wafer. But the dose is too bulky. Gelatin, and also membranous capsules, have been made to contain the oil, but their cost is objectionable.

The taste of the medicine is rendered less distinct by coating the mouth, before taking it, with a little currant or other jelly, or chewing a morsel of peppermint or cinnamon candy, before and after swallowing the dose. But of such expedients chewing a piece of smoked herring is the best.

If the oil excites nausea, the patient should lie down immediately after swallowing it; or a few drops of naphtha may be given with each dose. Sometimes a few days' preparation with hydrocyanic acid, or subnitrate of bismuth, will enable the stomach to retain the oil.

It should never be taken immediately before a meal, but in the middle of the morning and of the afternoon, and at bedtime.

A small dose should always be given at first, and gradually increased to a tablespoonful or two, three times a day. More than this is generally superfluous, and sometimes injurious.

In regard to the methods of administering the oil by *clyster*, and by *inunction*, it is enough merely to name them. The former cannot long be tolerated or be useful, and the latter, except in certain cutaneous affections, is objectionable for its uncleanliness.

POTASSII CHLORAS.—Chlorate of Potassium.

Description.—Chlorate of potassium may be prepared by passing chlorine gas through a warm and concentrated solution of carbonate of potassa. By this means chloride of potassium and chlorate of potassa are generated, and as the liquor cools the former remains in solution, while the latter is deposited in the form of oblique rhomboidal crystals of a pearly lustre. This salt is indorous, of a

[1] Med. Reports, p. 20.

cool saline taste, is perfectly neutral and anhydrous, and is but little changed by exposure to the air. On decomposition by heat it yields 39 per cent. of its weight of oxygen. Water at 60° F. dissolves only fifteen parts of it, but according to Hutchinson, 25 grains are soluble in an ounce of hot water. Chlorate of potassium does not precipitate albumen, and is said to be soluble in all of the animal fluids without decomposing them or undergoing any change itself.

History.—In 1786 this salt was discovered simultaneously by Berthollet and by Higgins. The former, who alone recognized its real composition and qualities, named it hyperoxymuriate of potassa *muriate suroxygéné de potasse*). It was first employed in medicine at the suggestion of the chemists, who presumed that the oxygen which it contains so abundantly would tend to counteract the putrefaction which, according to their theories, characterized certain diseases, and especially syphilis. Among the medical writers, at the beginning of the present century, who adopted these opinions were Rollo, Garnett, Cruikshank, Chisholm, Alyon, and Odier. Rollo boasted of the success of the medicine in scurvy, nervous fever, diabetes, and dysentery, as well as in syphilis,[1] and so persuaded was he of its singular virtues as to declare that it "merits a trial in hydrophobia."[2] Ferriar states that he found it efficacious in true scurvy, and he thought that the *soreness of the gums* was sooner healed by it than by ordinary remedies.[3] But the medicine did not, apparently, fulfil the promises made in its behalf, and except that about 1815 it was proposed by several German physicians as a remedy for neuralgia, as it had originally been by Chisholm, and that Ferriar's suggestion of its use in scorbutic sore mouth was acted upon by some Swedish practitioners, it appears to have been almost entirely neglected or forgotten. In 1831, it is true, Dr. O'Shaughnessy proposed the injection of a solution of the salt into the veins of cholera patients in order to revive the dark and morbid blood,[4] but it does not appear that the suggestion was carried out. From that time the medicine seems again to have been almost forgotten, until, in 1843, Dr. Hunt drew attention to it once more by a paper which he read before the Medico-Chirurgical Society of London, on the treatment of "Cancrum oris" by its means.[5] From that time to the present, examples of its success have continued to be published, in the treatment of atonic ulcers of the mouth, and analogous affections. Among these publications the monograph of M. Isambert is the most complete.

Action on the System.—It was early noticed that chlorate of potassium, when taken internally, gives to the venous blood a beautiful arterial tinge,[6] and Dr. O'Shaughnessy observed the same effect when a solution of the salt was thrown into the veins of animals.[7] Chisholm long ago said that its operative effects are fre-

[1] SPRENGEL, Hist. de la Méd., vi. 423.
[2] On Diabetes Mellitus, ii. Pref. xiii.
[3] Med. Hist. and Reflect. (Am. ed.), p. 388.
[4] Lancet, Dec. 1831, p. 368.
[5] Med.-Chir. Transactions, xxvi. 142.
[6] STEVENS, On the Blood, p. 156.
[7] Lancet, Dec. 1831, p. 368.

quently not obvious. When, however (he continues), these effects are evident, the pulse, the tongue, the gums and palate, the palms of the hands, the urinary secretion, and the blood, are most affected by it. The pulse becomes less frequent and full, the surface of the tongue and the gums are of a florid red, the secretion of urine is prodigiously increased, large doses produce a sense of constriction in the stomach, and the blood is remarkably florid.[1] M. Gustin found that two drachms of the salt taken at bedtime occasioned the next morning a sense of constriction of the mouth and slight nausea; the gums felt rough, the saliva was somewhat increased and more fluid than usual; the urinary secretion was not augmented, and the appetite was unusually good.[2] These statements are but partial, and do not entirely agree. More positive conclusions may be drawn from the observations of Isambert and others who have experimented with the salt. M. Isambert found that no sensible effects were produced upon himself by doses of from fifteen to sixty grains; he then gradually increased the quantity taken daily from two to five drachms, and as gradually diminished it again to thirty grains.

The larger doses occasioned copious salivation, with a saltish taste in the mouth. The salt was readily detected in the saliva. Under its operation the teeth became thoroughtly cleansed. When it was not well dissolved, some pyrosis was occasioned. The appetite was uniformly increased, and sometimes was ravenous. No purgative effect was observed by Isambert nor by Blache, but Hutchinson states that in drachm doses the medicine purges young children.[3] The first named gentleman found the alvine evacuations somewhat greenish. The chlorate could not be detected in them. In large doses it proved decidedly diuretic, and a painful sense of weight in the loins was felt. The urine continued strongly acid, and deposited a larger quantity than usual of uric acid, urates, and rosacic acid. O'Shaughnessy was the first to state that chlorate of potassium passes off unchanged by the urine.[4] Wöhler and Stehberger afterwards confirmed this statement,[5] and subsequently also Gustin, but the experiments of Isambert were more definite in their results. They show that within five minutes after the medicine is taken it may be detected in the saliva, and within fifteen minutes in the urine, and also that the elimination of the salt continues for a period of from fifteen to forty-eight hours. The maximum rate of its discharge is attained in an hour or two. It was detected in the milk of nursing women, in the tears, the nasal mucus, and the perspiration. It was also found, in a small proportion, in the bile of children who died while using it medicinally.

Some years ago Dr. Osborn suggested that chlorate of potassium might not always be a harmless medicine, but he offered no ground for his suggestion beyond the statement that in his own person

[1] An Essay on Malignant Pestilential Fever, 2d ed., i. 502.
[2] Bull. de Thérap., xlviii. 437.
[3] Times and Gaz., Aug. 1856, p. 192.
[4] In 1831, vid. supra.
[5] STRUMPF, Handbuch, ii. 632.

doses of five or ten grains occasioned some fulness of the head and dryness of the throat.[1] The suggestion was echoed by Mr. Weeden Cooke, but he, too, had no reason to give for it beyond this; that as the medicine was powerful for good, it might be for evil also.[2] There are only two examples of injury produced by chlorate of potassium. The one occurred in a case of phthisis for which a physician prescribed three hundred grains of the salt to be taken daily in solution. The unfortunate victim of professional ignorance took this dose on four consecutive days, when "the pains in his bowels became very severe, incessant vomiting came on, and finally death ensued." The stomach, after death, is reported to have been "inflamed on its external surface, while its mucous coat was entirely disorganized and softened."[3] The other was the case of Dr. Fountain, who took, at a single dose, an ounce of chlorate of potassium, to testify his belief in the perfect innocuousness of large doses of the medicine. A most violent gastro-intestinal inflammation occurred, with copious diuresis, followed by suppression of urine.[4]

[1] Lancet, Oct. 1859, p. 363. [2] Ibid., p. 449.

[3] Am. Med. Times, ii. 53.

[4] We have been kindly furnished with the following account of Dr. Fountain's illness and its results, by Dr. J. M. ADLER, now of Philadelphia, but who at that time was associated with Dr. Fountain professionally.

1028 ARCH ST., Aug. 9, 1874.

MY DEAR DOCTOR: The facts in the case of Dr. Fountain are as follows:—

March 22d, 1861, about 8 A. M. he took half an ounce of chlorate of potash dissolved in a goblet of warm water. He was actively occupied the entire morning, and nothing unusual occurred except free diuresis during the course of the day. After 4 P. M. the diuresis ceased, and there was nothing unusual in his appearance or condition in the afternoon, except that he was pale and looked fatigued. He ate heartily at dinner, was busy all the afternoon, and took supper about 7 P. M. About 8 o'clock he walked rapidly up hill, about half a mile, to see a patient, and while making the visit, was attacked with purging, vomiting, and cramps. He walked back to his residence. I was summoned to him about 9.30. Found him in a state of dangerous prostration and collapse; vomiting and purging, with intense pain and cramps; skin cold, with the hue of a person nearly asphyxiated. I made the customary external applications, and administered a full dose of morphia and brandy. He soon rallied, reaction was well established and his condition comfortable, and so he remained during the night. He slept quietly, and there was nothing in his appearance to warrant any apprehension, except the exceedingly dusky appearance of the skin. He attributed the choleraic symptoms to having eaten heartily of wild duck at supper. I left him at 6 A. M.; he walked with me to the front door, and expressed himself as feeling well. I returned at 8. During my absence he voided about two ounces of black colored urine. After this there was no secretion from the kidneys. When he called my attention to the urine, he remarked that he feared the chlorate had seriously injured his kidneys.

While conversing about the appearance of the urine, the choleraic symptoms returned, and it was only by the most persistent efforts that we were enabled to keep him alive during the day. The collapse was profound, but in the evening he rallied again. The purging ceased, and there was no further evacuation from the bowels during the six subsequent days of intense suffering. Violent enteritis, gastritis and cystitis ensued, almost incessant vomiting and intense pain, requiring the steady use of anodynes to make his condition bearable. He died just one week from the time of taking the chlorate.

The autopsy revealed what we expected, a general, intense inflammation of the entire alimentary tract, from the stomach to the rectum; portions of the mucous membrane were destroyed, hanging in ragged shreds and patches, as if the intestine had been macerated a long time in a strong alkaline solution. The mucous membrane of the bladder gave a similar appearance; the bladder was empty. There

In Dr. Fountain's case death took place on the seventh day. The fatal consequences of a dose of one ounce of the salt were certainly not to have been anticipated or even seriously dreaded, for in experiments performed many years ago by the late Dr. Tully half an ounce and then an ounce were several times taken without any alarming consequences whatever.[1]

Uses. *Mercurial Salivation.*—In a note to Jourdan's Pharmacopœia, published in 1840, vol. ii. p. 289, it is said, "Eyr [? Sir James Ayre] used twenty-five grains of chlorate of potassium in four ounces of water, of which three tablespoonfuls a day were given, for ulcers of the mouth following excessive salivation."[2] This is the first indication which we find of the salt having been used as a remedy for the effects of mercury. In 1846, Mr. John Allison, from the analogy which he presumed to exist between anæmia and the mercurial cachexia, and his belief in the power of chlorate of potassium to cure the former disease, was induced to prescribe it for mercurial salivation; and fortunately the experiment was perfectly successful.[3] Meanwhile M. Herpin, of Geneva, learning its virtues in ulcerative stomatitis, conceived the idea of applying it to the cure of mercurial sore mouth, and accordingly made some trials of it, which were also successful,[4] as were those made by Blache,[5] Demarquay, Aran,[6] Foucart, Venot,[7] Vidal,[8] Perrin,[9] Richard, and Isambert.[10] Among these writers Aran is the only one who states that the remedy, although generally successful, is by no means infallible. In England, Mr. Hutchinson, of the Metropolitan Free Hospital, called attention to its prompt success in two cases of mercurial salivation, and in the following year published several others of a like description.[11] In the United States, Dr. Gallaher, of Pittsburg, used it both internally and locally with entire success.[12] Under the operation of the medicine the purplish color of the gums is exchanged for their proper ruddy hue, the pain subsides, with the swelling and salivation, and there only remains the ulceration of the edge of the gums, which gradually, however, heals. M. Ricord has expressed the opinion that not only does chlorate of potassa cure ulcers occasioned by mercury, but that, if administered simultaneously with that medicine, it prevents salivation from taking place.[13] This opinion has been confirmed by M. Laborde.[14]

were crystals of the chlorate in the pelvis of the kidneys, and a large bulla of extravasated urine (apparently) under the capsule of one kidney.

* * * * * * * * * *

Very truly yours, etc.,
JOHN M. ADLER.

ALFRED STILLÉ, M.D., 3900 Spruce Street.

[1] Am. Med. Times, iii. 3.
[2] HERPIN, Chlorate de Potasse, p. 31.
[3] Lond. Med. Gaz., 1846, p. 953.
[4] Bull. de Thérap., 1854, xlviii. 26.
[5] Ibid., p. 120.
[6] Ibid., p. 437.
[7] Ibid., li. 88.
[8] Abeille Méd., xiii. 221.
[9] Brit. and For. Med.-Chir. Rev., Jan. 1857, p. 262.
[10] Etudes, etc. sur le Chlorate de Potasse, p. 31.
[11] Times and Gazette, Nov. 1855, p. 471, and Aug. 1856, p. 174.
[12] Am. Journ. of Med. Sciences, July, 1857, p. 64.
[13] Bull. de Thérap., li. 181.
[14] Ibid., liv. 115.

Non-mercurial Salivation.—This medicine would appear to be very efficacious in controlling the salivary secretion, even when it proceeds from simple inflammation. In a case of profuse salivation resulting from an attempt to commit suicide by swallowing about an ounce of caustic *ammonia*, M. Fonssagrives arrested the discharge by means of a solution of chlorate of potassium after numerous other remedies had failed.[1]

Ulcerative Stomatitis.—In this affection, which commences "by small ulcers either on the inside of the cheek or lips, or at the point of junction of the mucous membrane of the cheek and gums, or with the gums themselves, separating them from the teeth," chlorate of potassium, in doses of from twenty to sixty grains a day, was first shown by Dr. Hunt and Mr. Hawkins, to be a prompt and certain remedy when employed at the commencement of the attack.[2] Not unfrequently the ulcers are large, and are covered with a pultaceous pseudo-membranous deposit, assuming an almost gangrenous appearance, and exhaling a fetid smell. The gums are swollen and spongy, and readily bleed. It is important to observe that these ulcers have a very slight tendency indeed to heal, and, therefore, a medicine which will cause them to do so is of great value. Such an one chlorate of potassium may claim to be. Dr. West says that it appears to be almost a specific for this affection,[3] and Dr. J. F. Meigs has seldom found it necessary to employ any other means.[4] With Dr. Risdon Bennett, its use was attended with the best results;[5] Mr. Headland and Golding Bird prescribed it with much benefit;[6] Mr. Babington was equally successful in its employment during an epidemic of the disease at the Coleraine Union Workhouse in 1849;[7] and Dr. Hicks in one (which he incorrectly described as of aphthæ).[8] To these may be added the equally favorable results of Blache, Mazade,[9] Bergeron, Hutchinson, and Isambert. As in the case of mercurial sore mouth, the first effect of the salt in this disease is to impart a livelier color and greater vigor to the affected parts; the serrated edges of the false membrane are rounded off, the swelling subsides, and the false membrane itself is cast off between the third day and the fifth, and perhaps is succeeded by another, but a smaller one, while the ulcer fills up and tends to heal. Generally the cicatrization is perfect; but sometimes a linear ulcer remains, which it requires the action of lunar caustic wholly to cicatrize. (*Isambert.*) It appears that in this affection the size of the dose is not always a measure of its efficacy; two or three grains, and twenty or thirty grains, in different cases appear to have been equally efficient.

There is also much doubt whether the remedy is not in a great degree local in its operation. The experiments and observations of

[1] Bull. de Thérap., lii. 231.
[2] Med.-Chir. Trans., xxvi. 142.
[3] Diseases of Infancy and Childhood, 3d ed., p. 432.
[4] Diseases of Children, 2d ed., p. 236
[5] Lancet, Oct. 1844, p. 114.
[6] Ibid., March, 1846, p. 278.
[7] Dublin Quart. Journ., Feb. 1850, p. 236.
[8] Times and Gaz., June, 1858, p. 611.
[9] Bull. de Thérap., l. 537.

M. Laborde appear to render it certain, at least, that the topical application of the medicine is quite sufficient for a cure[1] of the disease more particularly in question, and those of Bouchut,[2] Cerboni,[3] and Mr. Hutchinson,[4] for the cure of ulcers in various parts of the body, confirm this conclusion. Additional illustrations will be found below.

In this connection may be noticed the beneficial effects of the medicine in *scurvy*. As already stated, it was once highly recommended by Rollo as a remedy for this disease, but quite recently we have the evidence of an English naval surgeon in support of its efficacy,[5] and Dr. Fountain, of Davenport, Iowa, reported its unequivocal advantages in a mild epidemic of land scurvy, in which the symptoms were for the most part local.[6]

Follicular Stomatitis. Aphthæ.—This is a much slighter affection than ulcerative stomatitis, and, in general, tends spontaneously to cure, but its removal is expedited by the administration of the chlorate. This would appear to result from the observations of Mr. Hutchinson. Dr. Hauner, of Munich, reports it as having been successful in seventy cases of the disease in doses of from half a drachm to a drachm given in the twenty-four hours.[7]

Gangrenous Stomatitis.—A case stated to have been of this disease occurred under the care of M. Blache in the course of typhoid fever affecting a child six years of age. At first, the attack presented the usual characters of ulcerative stomatitis, but by degrees a hardened spot formed in the cheek. At this time chlorate of potassium was administered, and the inflammation spread no further.[8] There is reason to suppose that in this case the affection of the cheek was merely sympathetic with the ulceration of the gums, and that it declined as the latter subsided under the influence of the medicine. In that rare affection, true gangrenous stomatitis, it is doubtful whether chlorate of potassium would exercise more influence than the ordinary remedies for the disease. It might not be amiss to employ it along with the tonics and stimulants which are the chief dependence in treating this fearful malady.

It is a curious and interesting fact that occasionally chlorate of potassium produces ulceration of the mouth when administered for diseases in which the buccal membrane is unaffected. It was first noticed by Mr. Hutchinson,[9] and cases corroborating his statement have been published by Mr. Traill,[10] a writer in the *Medical Times and Gazette*,[11] and others. These facts prove that the medicine is a powerful stimulant, and that it is curative of the various diseases in which it is administered, by virtue of its stimulant power. It will be remembered that they are all diseases of impaired vitality.

[1] Bull. de Thérap., liv. 289.
[2] Ibid., lv. 429.
[3] Ibid., lvi. 575.
[4] Lancet, Dec. 1857, p. 648.
[5] Times and Gaz., Nov. 1857, p. 476.
[6] New York Journ. of Med., July, 1859, p. 5.
[7] Edinb. Journ., Oct. 1856, p. 370.
[8] Bull. de Thérap., xlix. 227.
[9] Lancet, March, 1858, p. 265.
[10] Ibid., April, 1858, p. 375.
[11] May, 1858, p. 527.

Buccal and Pharyngeal Diphtheritis.—Mr. A. Smith has reported a well-marked case of pseudo-membranous inflammation of the tongue and cheeks occurring in an adult female, and which rapidly got well under the administration of a scruple of chlorate of potassium every four hours.[1] So when a diphtheritic deposit exists upon the velum, tonsils, and posterior fauces generally, with swelling of the submaxillary glands, the remedy is often promptly efficacious. M. Isambert publishes eight cases of this affection, demonstrating its curability by the remedy under consideration, at least so far as the separation of the false membranes is concerned, after which nitrate of silver completes the cure. M. Chavane states that he had nineteen cases of this affection which recovered under the use of the chlorate without other treatment, and generally in about four days. The quantity of the salt required for each case varied between three and five drachms.[2] Examples of similar success are reported by Dr. Garasse.[3]

Croup.—The virtues displayed by chlorate of potassium in the diphtheritic affections above mentioned, and especially in those of the pharynx, suggested to M. Blache the idea of employing it in the treatment of membranous croup. It appears, however, that the method had been proposed and practised by Chaussier as long ago as 1819. This physician, after having obtained some amelioration of the symptoms by means of emetics, administered the chlorate two or three times a day in doses of from six to eighteen grains, and continued it for several days until the symptoms ceased, and even afterwards in smaller quantities. (*Isambert.*) At the time when this recommendation of Chaussier was made, various saline or alkaline preparations were in use with a view of producing solution of the croupal false membrane, such as the carbonate of ammonium, and the sulphuret of potassium. The latter, indeed, was vaunted as infallible. They fell into disuse; but the chlorate of potassium, which does not appear to have been employed by any one but Chaussier, is now revived with perhaps a better prospect of continuance. In the wards of M. Blache, at the Children's Hospital of Paris, four cases of membranous croup appear to have recovered under the sole influence of this preparation; and in several others in which tracheotomy also was employed, the results were more favorable than can fairly be attributed to the operation alone. In some cases, also, of secondary croup, the remedy is represented by M. Garasse to have been completely successful.[4] Nearly all of the cases above referred to seem to have been those in which the diphtheritic inflammation extended to the larynx from the fauces, and to have assumed the moderately asthenic type so usual in hospital practice; it may, therefore, perhaps be questioned whether in primitive laryngeal or tracheal croup, the medicine would prove as serviceable. If, however, more extended experience should confirm the results already obtained,

[1] Bull. de Thérap. xlviii. 558, from Dublin Hosp. Gaz.
[2] Abeille Méd., March, 1857, p. 71. [3] Ibid., May, 1857, p. 121.
[4] Ibid., p. 121.

the introduction of chlorate of potassium into the treatment of croup would be of incalculable value.

In this connection the suggestion made by M. Barthez may be referred to. This physician found that false membrane introduced into a solution of chlorate of potassium or chlorate of sodium, but especially into the latter, undergoes softening much more speedily than it does in water alone. He accordingly has proposed to use these solutions locally as well as internally in diphtheritic affections, and in croup, to instil them into the air-passages after the operation of tracheotomy.[1]

Subacute *bronchitis*, and the acute form after the febrile symptoms have subsided, appears to be favorably modified by this medicine given in doses of from ten to twenty grains sufficiently diluted and repeated at intervals of three or four hours. It seems to diminish the bronchial secretion, and with it the rhonchi, the cough, the expectoration, and the oppression.

Facial Neuralgia.—Chlorate of potassium appears to have been first employed in this affection by Chisholm, who by means of it cured a very aggravated case of *tic doulourenx*, which all other remedies had failed to relieve.[2] The dose employed was thirty grains a day. The effect is said to have been wonderful indeed; no other treatment whatever was used, and at the expiration of three weeks' continued exhibition of the remedy, the patient was entirely freed from the complaint. Sachs and Dulk[3] state that, after personal experience with the medicine, they regard it as the surest of all remedies that have been proposed for facial neuralgia; yet they, after all, admit that it is rather a palliative than a cure. Other German physicians used medicine with good effect, as Knod, Herber, and J. Frank, the last of whom states that by its means he cured a case in which section of the nerve could not be employed.[4] Dr. Copland thinks it not without efficacy in the rheumatic and hysterical states of the disease.[5]

Dr. Watson states that, at the suggestion of Dr. Hunt, he is in the habit of directing a solution of the chlorate of potassium in water (ʒj to Oj) as a drink for patients in *scarlet fever* and in the *typhoid forms* of continued fever.[6] He found in many instances that under the use of a pint or a pint and a half of this solution daily, the tongue, from being furred, or brown and dry, became cleaner and moist. In all typhoid or so-called malignant types of febrile disease, the use of the medicine would appear to be indicated, whether they arise from an original depravation of the blood, or secondarily, from the absorption of the products of decomposition of the tissues. This class of cases includes all in which there is a tendency to gangrene, or in which it actually exists.

[1] Amer. Journ. of Med. Sci., Oct. 1858, p. 514.
[2] An Essay on the Malignant Pestilential Fever, 2d ed., ii. 450.
[3] Handwörterbuch der prakt. Arzneim., 2ten Theil. 2te Abtheil, s. 536.
[4] Pathologie Méd., trad. française, iii. 297.
[5] Dict. of Med. (Am. ed.), ii. 1023.
[6] Prac. of Med. (3d Am. ed.), p. 1002.

The oxygenation of the blood produced by chlorate of potassium was very ingeniously applied by Dr. Fountain.[1] He first employed it experimentally in a case of *cyanosis* depending upon organic disease of the heart. After the first few doses of the medicine the peculiar blue color of the skin entirely disappeared, and the dyspnœa was much relieved. Subsequently, in a case of profuse hemorrhage into the right pleural cavity, from a wound of an intercostal artery, and in another of hydrothorax, both of which presented striking indications of venous congestion of the heart, this medicine relieved the symptoms in a very striking manner, and sustained life long enough for nature to complete the cure. The same influence which was exerted in these cases was invoked by Dr. Bruce[2] to prevent *abortion* in several pregnant women who had experienced this mischance repeatedly and never borne a living child. Apparently under the influence of the treatment pregnancy reached its full term in each case, and the children were both alive and vigorous. Drs. Pattison, Inglis, Keiller, and Balfour have confirmed from their own experience the value of this method. The quantity of the salt usually administered is about sixty grains a day. In 1869, at a meeting of the Obstetrical Society of Edinburgh, the value of chlorate of potassium in preventing abortion in certain cases was illustrated by Dr. Cuthbert and others, among whom was Sir James Simpson. He said that he gave it on account of disease of the placenta, but he believed that it was also a means of arterializing the blood. He was led to use the chlorate in such cases by the experiments of Davy and Stevens, who pointed out that an alkaline salt when brought into contact with blood gave it an arterial appearance. At one time he imagined that its good effects were attributable to the amount of oxygen which the salt contained.[3]

Dr. Copland assures us that small doses of the medicine in a draught, or by injection, are very serviceable in the advanced stage of *cholera infantum*, especially when the disease passes into a dysenteric state, with great exhaustion, and offensive stools. In chronic diarrhœa he refers to the same treatment as very beneficial.[4]

At the commencement of the present century, Odier, of Geneva, asserted that he had cured by means of this preparation, not only spasmodic *jaundice*, but even cases which appeared to depend upon a biliary calculus, or some other impediment to the discharge of the bile. M. Isambert mentions that the Genevese physicians, in imitation of Odier, continue to use this salt in the treatment of jaundice, and he relates some cases in which it was prescribed. They do not appear to be very conclusive of its efficacy.

Lombard employed chlorate of potassium in doses of fifteen or eighteen grains every four or six hours in cases of *anasarca* and *ascites* following typhoid fever.[5] A Scottish surgeon, Mr. Craig, has re-

[1] New York Journ. of Med., July, 1859, p. 1.
[2] Edinb. Med. Journ., xi. 669.
[3] Ibid., xv. 85.
[4] Dict. of Med. (Am. ed.), i. 384 and 612.
[5] Med.-Chir. Rev., April, 1841, p. 507.

ported four cases of what appear to have been *ovarian tumors*, cured by the prolonged administration of a desertspoonful three times a day of a saturated solution of chlorate of potassuim.[1] Socquet, of Lyons, attributed to it a marked sedative influence in acute articular *rheumatism;*[2] but no estimate of its influence can justly be formed, as in his treatment bleeding and blisters were used at the same time.

In several other diseases, as *syphilis*, and even *rabies canina*, this salt is reported to have been of service; but of such statements it is unnecessary to speak further than to say, that in some cases of secondary syphilitic ulcerations the internal use of the remedy appeared to hasten their cure. Dr. Fountain, who fell a victim to his zealous investigation of this medicine, believed it, on theoretical grounds, to be a peculiarly appropriate remedy in the early stages of *phthisis;*[3] and a physician of Belfast, after satisfying himself that it ought to cure the disease, persuaded himself that it is actually endowed with this virtue above all price.[4] But Dr. Austin Flint, in this country,[5] and Dr. Cotton, in England,[6] after a sufficient trial of its powers, concluded that it has no specific action in phthisis, and, in the confirmed disease, at least, does not arrest or retard its progress. Chisholm speaks of its having cured a *hydrocele* of a year's standing. Mr. Hutchinson is of opinion that *ulcers, abscesses, eruptions*, etc., connected with a cachectic state of the constitution, are generally benefited by its use. A remarkable instance of its efficacy is reported by M. Ganjot, in the cure of large phagedenic ulcers of the groin which followed syphilitic buboes, and obstinately resisted every application, until a simple dressing of lint soaked in a solution of chlorate of potassium was employed, of the strength of one part of the salt to twenty-five of water. Under this alone the ulcer cicatrized.[7] M. Tillot also found an ointment composed of one part of the chlorate to seven or eight of lard, or even three or four times weaker than this, preferable to any other application in the treatment of phagedenic soft *chancres.*[8]

Locally, a solution of chlorate of potassium has been found very useful in correcting the fetor, and improving the condition of *ulcerated surfaces* in cancer, phagedæna, and ozæna, deodorizing fetid mucous discharges, offensive breath, etc. A solution made by dissolving a drachm and a half, and from that to three drachms, of the salt in a pint of water, is recommended by Mr. C. H. More.[9] Dr. Henry has reported two cases of *ozæna* which had proved intractable to various other means, but were cured by snuffing a solution of one drachm of the salt in four ounces of water,[10] and Dr. Ormerod employed it successfully in a case of the same disease.[11]

[1] Edinb. Med. Journ., xi. 427.
[2] Bull. de Thérap., xlvii. 255.
[3] Am. Journ. of Med. Sci., Jan. 1861, p. 235.
[4] Dublin Quart. Journ., Nov. 1861, p. 338.
[5] Am. Journ. of Med. Sci., Oct. 1861, p. 321.
[6] Times and Gaz., May, 1862, p. 531.
[7] Bull. de Thérap., lxviii. 273.
[8] Ibid., lxx. 245.
[9] Lancet, May, 1855, p 514.
[10] Bull. de Thérap., lii. 430.
[11] Lancet, Oct. 1858, p. 386.

Dr. B. Brown, of North Carolina, used injections of a solution of chlorate of potassium (ʒj to Oss) in cases of *leucorrhœa* attended with ulceration of the os uteri and cervical canal, and enlargement of the muciparous glands of the vagina, and also for simple *ulceration* of these parts without leucorrhœa.[1]

M. Mazade found that lotions or gargles containing this preparation are very useful in removing *aphthous* and *pseudomembranous ulceration* of the mouth and fauces, occurring during certain epidemics.[2] Indeed, as already remarked, it may be questioned whether in the internal administration of the medicine a portion of its good effect is not due to its local action during deglutition. Gibert has shown this to be probably the case by the results which he obtained in similar affections to the above, by using the salt in substance finely powdered, or gargles which contained it.[3] In like manner Lasègue cured *mercurial sore mouth* by strong solutions of chlorate of potassium, locally applied.[4]

Administration.—Chlorate of potassium is generally administered in solution. The dose for children under three years of age is about *five* grains three or four times a day, and for an adult from *ten* to *thirty* grains. It should first be dissolved in hot water, and then a sufficient quantity of gum and sugar added to suspend the undissolved portion. The best time for its administration is before meals.

As a *lotion*, from sixty to one hundred and twenty grains may be dissolved in four ounces of water, and, if the sensibility of the part be great, a large proportion of water may be used.

AMMONII CHLORIDUM.—Chloride of Ammonium; Sal Ammoniac.

AMMONII CHLORIDUM PURIFICATUM.—Purified Chloride of Ammonium.

Description.—Chloride of ammonium is found native near some volcanoes. It exists also in many coal mines, and in certain mineral waters. As intimated below, it was formerly prepared from the soot produced by burning camel's dung. At present it is obtained from the ammoniacal liquors formed in the manufacture of coal gas and animal charcoal. On the addition to them of sulphuric acid, a sulphate of ammonium is produced, and this, when heated with chloride of sodium, produces, by double decomposition, sulphate of sodium and chloride of ammonium, the latter of which is obtained by sublimation.

In commerce it generally occurs in large cup-shaped cakes having a hole in the centre. It is white, translucent, fibrous, and some-

[1] Am. Journ. of Med. Sci., July, 1857, p. 66.
[2] Bull. de Thérap., l. 344.
[3] Ibid., p. 524.
[4] Isambert, op. cit., p. 34

what tough, and by exposure to the air becomes slightly moist. It is soluble in alcohol, and in cold, but more readily in hot water, and generates cold during its solution. Its taste is saline, pungent, and very disagreeable. On being mixed with the alkaline earths, it disengages ammonia. The purified chloride is obtained by adding water of ammonia to a hot solution of chloride of ammonium, filtering the liquid, and evaporating it to dryness. It is a snow-white, crystalline powder.

History.—The sal ammoniac of the ancients is supposed to have been rock salt, and to have derived its name from the circumstance of its being procured near the temple of Jupiter Ammon, in Libya. The temple itself was called after the province Ammonia, in which it was situated, a name which signifies sandy (from ἄμμος, sand). In the middle ages chloride of ammonium was known as *sal armoniacum*, or Armenian salt, in reference to one of its commercial sources. The Arabian physicians speak of its preparation from the soot made by burning camel's dung; of its application to the eye for the removal of leucoma; of its use to cure relaxation of the palate; and of its power of determining the humors to the surface of the body. They also refer to its being mixed in a liniment of oil and vinegar for the cure of itch.[1]

In modern times there was but little recorded of its use as a medicine until the last century, when it became a favorite remedy with German physicians, and continues to be regarded by them as in many cases a profitable substitute for mercury, antimony, or iodine.

Action. *On Animals.*—Viborg injected a drachm of sal ammoniac dissolved in two ounces of water into the jugular veins of horses. The first effect was to produce excitement, but afterwards the animals appeared singularly depressed. According to Smith's experiments,[2] when from one to two drachms of the salt were applied to a wound in a dog's thigh, the animal gave signs of general distress and debility, vomited frothy mucus, and died exhausted in from twelve to thirty-six hours. On dissection, the mucous membrane of the stomach was ulcerated and gangrenous, and that of the small intestines softened. When Orfila introduced the same quantity of the salt dissolved in two ounces of water into the stomach of a dog, symptoms were produced resembling those just described, in this, that debility appeared immediately to follow the operation, but was succeeded by a state of great excitement with evidences of suffering, convulsions and tetanic rigidity of a high grade. The same quantity of the dry salt was administered to another dog, and the symptoms were identical with those in the first experiment. In neither case were the lesions which Smith described found in the stomach.

Mitscherlich, who repeated these experiments upon rabbits, observed the same symptoms of depression followed by spasm, and after death a large increase of the mucous secretion of the stomach

[1] EBN BAITHAR, ed. Sontheimer, ii. 563.
[2] De vi et usu salis ammoniaci, 1826, quoted by WIBMER, Wirkung, etc., i. 143.

and intestines, some softening of the epithelium, and slight vascular injection. The blood was unusually liquid, and formed a small clot.[1] These results agree perfectly with Orfila's, and show that the lesions described by Smith were not due to chloride of ammonium. Arnold, who also used rabbits in his experiments, reports that he found some softening and injection of the gastric mucous membrane, but nothing more.[2]

Gieseler found that dogs were seized with vomiting in an atmosphere highly charged with the fumes of chloride of ammonium, and frogs were rapidly destroyed, the skin of their bodies exuding mucus copiously, while the limbs became very dry. Copious evacuations took place from both mouth and anus before death, and afterwards putrefaction set in rapidly.

On Man.—At the close of the last century, Gmelin[3] said of this salt, that it is by far the most powerful of saline preparations, whether as an internal or an external agent, "for dissolving viscid and stagnant humors and preventing putrefaction." He further stated that it irritates the stomach and bowels, dissolves their *sordes* accumulated by torpor, promotes secretion from mucous membranes and the uterus, and overcomes "obstructions of the mesentery." These views, although couched in the medical dialect of the day, correspond closely with the results of recent experiment. According to Sundelin,[4] it exerts a sedative influence on the system. Indeed, its action on the secretions appears to be partly due to this cause, and to a direct operation upon the blood, whereby it diminishes the plasticity of the latter, and thus promotes glandular secretion and the absorption of fibrinous exudations. By this view of the action of the salt, Sundelin vindicates his classing it among the alterative remedies, and his comparing it with mercury. The more recent, painstaking, and exact investigations of Böcker, tend to support this theory. He has shown that during the use of the salt the proportion of urea excreted is augmented; that the stools become somewhat softer, and are largely mixed with mucus; that it increases the secretion of all the mucous membranes, and slightly that of the skin; and that, in the beginning of its use, at least, it diminishes the proportion of solid constituents in the blood.[5] This writer considers its therapeutical action to depend chiefly upon its quickening the "moulting," or waste (*Mauserei*), of the mucous membranes, and to some extent, also, of the skin, whereby these organs are enabled to resume their healthy action, when it has become suspended, or is feebly performed under the influence of inflammation. Hence the remedy is not an appropriate one in the primary and active stage of mucous inflammation, but rather in that later period characterized by morbid secretion, and a sluggish state of the reparative powers. But caution is here to be exercised. If the medicine is too long continued, it may induce a complete

[1] Lehrbuch der Arzneim., ii. 300.
[2] Archives Gén., xix. 402.
[3] Apparat. Méd., Pars II., i. 84.
[4] Heilmittellehre, i. 150.
[5] Beiträge zur Heilkunde, ii. 150.

destruction of the mucous membrane, instead of promoting its repair. Its protracted use is especially to be avoided in young persons, because in them the repeated waste and renewal of the mucous membrane cannot be borne.

In regard to the effects of very *large doses* of this medicine, they would appear to be less apt to be poisonous to man than to animals. A case of fatal poisoning in man, cited by Mérat and De Lens, we have been unable to find, on reference to the place indicated by these authors, but, in its stead, an account of the detection of the salt in the blood and various secretions of a horse.[1] On the other hand, Oesterlen states that, by mistake, one of his patients took *two ounces* of chloride of ammonium at a single dose, without any other result than trifling colic and watery stools.[2]

Uses.—The following are the principal therapeutical applications of chloride of ammonium. It is recommended in continued *fevers*, to be given about the height of the disease, in order to promote critical evacuations, particularly in cases of a typhoid type. In *eruptive fevers*, and especially in measles, when the eruption is tardy and imperfect, and the patient's system is sluggish rather than feeble, it is much employed by German physicians.

Hoffmann, Tissot, Werlhof, and others of the last century, extol its efficacy, especially in obstinate *intermittent fevers* of a quartan type. (*Gmelin.*) It had, however, ceased almost entirely to be used for this purpose, when, in 1851, M. Aran, finding, in a Memoir of Muys, published at the beginning of the last century, that great efficacy was attributed to the medicine in the cure of these complaints, made use of it in the treatment of thirteen cases, of which five were of the tertian, and seven of the quartan type, and one irregular. Six of the cases were of African origin. The medicine was given in each interval, and after the paroxysm, in two doses, of one drachm each, dissolved in an ounce and a half or two ounces of an aromatic water. Each dose was followed by a cup of coffee without milk. It caused neither headache, uneasiness, sweating, nor urination, and vomiting in two cases only when it was given immediately after the paroxysm. Of the thirteen cases, seven had no return at all of the disease, four had only one fit, and of the remaining two cases, one had a third and the other a fourth paroxysm. These results are certainly indicative of the medicine possessing some, and not a little, power over intermittent fever. But it must be taken into account that the patients were, while under treatment, far removed from the locality in which the disease had been contracted. In 1851–2, M. Jacquot made use of the medicine in treating soldiers of the French army occupying Rome. He gave from two to five drachms of it as the daily dose, and observed that it often occasioned slight colic, looseness of the bowels, sour eructations, and even vomiting, effects which perhaps were not without

[1] Compare Mérat and De Lens, Mat. Med., i. 247, and Journ. de Méd. de Leroux, xix. 155.
[2] Heilmittellehre, 4te Aufl., p. 556.

their influence on the results of the treatment. These results consisted in the abrupt cessation of the paroxysms in six out of twenty-one cases; but in two of the six cases the attacks returned.[1] The locality in this case was a malarious one, the same, indeed, in which the disease had been engendered.

In *bronchial catarrh*, after the first or inflammatory stage has subsided, chloride of ammonium promotes expectoration, and hastens the cure. It is said to be peculiarly adapted to cases which have their origin in a rheumatic or gouty metastasis, and in certain *influenzas* which are marked by the former character. In *chronic* inflammations, or *fluxes* of the lungs, with a tenacious mucous or muco-prulent discharge, it is often the means of affording marked relief. Nebulized water containing a small proportion of this salt (gr. ij to gr. lx) may be inhaled with decided advantage in *chronic catarrhs*, either to promote the bronchial secretion upon the one hand, with the weaker solution, or with the stronger to diminish it. Continued experience has only confirmed our impression of the value of this medicine in the cases referred to. It is especially beneficial in senile catarrh and all forms of bronchitis occurring in feeble and impressionable persons. By Dr. Rae it was found of great service in *whooping-cough*. Under its use the sputa lose their glairy and tenacious qualities.[2] Oesterlen recommends it strongly as a remedy for *gleet*, in doses of half a drachm or more every two or three hours. "In cases of congestion of the mucous membranes," says Sir George Lefevre, "in *chronic sore throat*, with elongated uvula, and a flabby state of the tonsils and parts about the fauces, it is very beneficial. In that state of the mucous membrane of the stomach, caused by the action of a variety of medicines, which gives rise to the anorexia accompanying convalescence, I have seen it employed with happy results. The tongue loses its pallor, and acquires a healthier appearance from its use, and it paves the way advantageously for the more decided tonics in the convalescence after gastric fever."[3]

In *leucorrhœa* depending upon an atonic condition of the uterine organs, and in *amenorrhœa* occasioned by cold in young women of a torpid, phlegmatic constitution, Sundelin found it a very efficient remedy. Dr. Cholmeley, whose experience in its use was very large, describes differently the constitution in which it is the most appropriate remedy for this suppression. He says: "In delicate and nervous girls and women, suffering from amenorrhœa, and especially when this has followed exposure to cold and wet, I almost always give it, and it very seldom disappoints me."[4] The latter opinion is the most in accordance with our own experience, perhaps because females of a nervous constitution in this country outnumber those described by Sundelin. Dr. Cholmeley also found the ammonium chloride of great advantage in *dysmenorrhœa* in highly

[1] Arch. Gén., 1854, 5ème sér., iii. 699.
[2] Lancet, Dec. 1858, p. 604. [3] Ibid., April, 1843, p. 147.
[4] St. Andrew's Med. Grad. Assoc., 1869, p. 109.

nervous or rheumatic subjects. It quickly lessened the pain and increased the flow, and if taken continuously a perfect cure not unfrequently followed. He also used it very successfully to relieve the nervousness and depression of spirits, the chills and flushings, the giddiness, and various irregularities of circulation, attendant on the *change of life* in women.

Chloride of ammonium has been reputed of great efficacy in various forms of chronic *glandular enlargement*, from simple hypertrophy and congestion, on the one hand, to scirrhus on the other. It is probably of use only when the enlargement results from retained secretions, or from plastic deposits. Dr. Rae reports that he cured a number of cases of *goitre* in young girls by this medicine alone. In certain cases of chronic enlargement of the *liver* with jaundice, and originating from cold, it appears to have been of service. An instance of the sort is reported by Dr. Finn, of Dublin. A female, presenting the symptoms mentioned, had been under treatment for five months, and had been mercurialized without benefit. Within a few days after she began to take chloride of ammonium her disease declined, and she ultimately recovered.[1] Dr. W. Stewart claims that this medicine in doses of twenty grains two or three times a day is most efficient in preventing hepatic abscess if given in the decline of acute *hepatitis*, and in curing the chronic form of this inflammation.[2] The field of Dr. Stewart's observation was India.

Dr. Eben Watson has represented this preparation to be an efficient remedy for *neuralgia* of the fifth pair of nerves, and refers to two cases in which the pain ceased within a few minutes after it had been taken. He gave it in two or three doses, of twenty grains each, and at intervals of twenty minutes.[3] Sir Thomas Watson also alludes to the utility of the medicine "in a kind of face-ache which cannot properly be reckoned a species of neuralgia," and which, indeed, appears to be rather a rheumatic affection of the lower jaw. The superior efficacy of the iodide of potassium in relieving it renders this supposition probable. Nevertheless, genuine neuralgia has been found amenable to the power of the medicine by Dr. Cholmely, who cites a case of violent tic douleureux, in which half drachm doses of the chloride habitually gave prompt relief. In neuralgic *headache* or hemicrania, and also in certain cases of so-called nervous or sick headache, he found the relief produced by it prompt and decided. Dr. J. W. Curran recommends it associated with tincture of aconite for the relief of ovarian neuralgia.[4] This, however, is to undervalue the action of the aconite. It is also of great advantage in the treatment of *myalgia* and other forms of muscular pain, as well as in neuralgic *sciatica*. By the first-mentioned term Dr. Inman understands an aching pain which occurs in any muscles which have been continuously overstrained by

[1] Dublin Quart. Journ., Aug. 1856, p. 231. [2] Lancet, May, 1870, p. 726.
[3] Indian Annals, and Bull. de Thérap., xlvii. 543.
[4] Med. Press and Circular, Aug. 1868.

the prolonged repetition of certain movements, as in the case of shoemakers and sempstresses. It was first recommended for this ailment by Dr. Anstie[1] who also found it extremely useful in relieving neuralgia of the intercostal nerves in persons of feeble constitution or in impaired health. In *hepatalgia*, also, which must not be confounded with hepatic colic, this medicine often occasions prompt and permanent relief, acting, as Dr. Anstie remarks, "like a charm" and cutting short the attack. Chloride of ammonium has been recommended in chronic *arsenical poisoning*, with a view of eliminating the poison from the system.[2]

Externally this salt has been found of use as an ingredient of *dentifrice* with Peruvian bark. It is said to whiten the teeth. It has also been used as a wash for *gangrenous* parts in a solution of from one to three drachms to a pint of water. A case of spontaneous gangrene of the foot is stated by M. Gree, to have been, on two occasions, arrested by the application of chloride of ammonium in local baths and cataplasms.[3] A solution in vinegar is much employed for *contused and lacerated wounds*,[4] and to remove the soreness and blackness of contusions. A similar solution, or an ointment containing one part of the salt to five or six of lard, is of peculiar advantage in reducing the size of *indurated glands*, and even of other tissues which remain thickened and hardened after inflammation.

In all *local inflammations*, particularly of the eye, brain, mamma, testicles, joints, etc., the cold produced by a solution of the salt may be taken advantage of. Several formulæ are proposed, as 24 parts of water, 8 of vinegar, and 1 of sal ammoniac; or 32 parts of sal ammoniac, 10 of nitre, and 52 of chlorate of potassa, with from four to six times the quantity of water. "Walker found that five parts of this salt with five of nitrate of potash, and sixteen parts of water, lowered the thermometer from 50° to 10° F. A freezing mixture of this kind placed in a bladder, has been recommended by Sir A. Cooper as an application (ice-poultice) to hernial tumors." (*Pereira.*)

As an *errhine* the powder of this salt is very efficient in coryza and obstruction of the nostrils.

As a *gargle* in sore throat it is useful, particularly in the chronic form with dryness of the mucous membrane.

A solution of sal ammoniac is said to form a good *cosmetic* for removing pimples from the face. It is also alleged to destroy *warts* when a strong solution of it is kept applied to them.

A plaster made with lead and soap plasters in which a large proportion of muriate of ammonia has been incorporated is highly recommended by Mr. Martyn for "*housemaid's knee.*"[5]

Gieseler reports that the fumes of very dry chloride of ammonium given off by heating the salt upon hot iron are very efficacious in

[1] Practitioner, i. 358.
[2] HANNON, SCHMIDT'S Jahrbücher, Bd. 69, No. 1, 1851.
[3] Annuaire de Thérap., xxviii. 165. [4] Med. Facts and Obs., vi. 8
[5] BRAITHWAITE, Retrospect (Am. ed.), xlv. 113.

all *chronic pulmonary affections*, *chronic ophthalmia*, and *chronic vesical catarrh*. The most ordinary immediate effect is to increase the perspiration.[1]

Administration.—The disagreeable taste of chloride of ammonium is best concealed by a solution of extract of liquorice.

Its dose may vary from *five to thirty grains*, or even more, given at intervals of two or more hours. The smaller doses are best adapted to cases of chronic disease in which the alterative action of the remedy is desired.

SARSAPARILLA.

Description.—Sarsaparilla is the root of *Smilax officinalis* and of other species of Smilax. These are all trailing plants with prickly stems, and hence the etymology of the name—*sarza*, a brier, and *parilla*, a little vine.

Several species of smilax are natives of Mexico and the northern part of South America. According to the port whence it is shipped different names are applied to it, as Vera Cruz, Honduras, Brazil, and Jamaica Sarsaparilla. The roots, with or without the rootstalk, are dried and folded in bundles, and are thus found in commerce. The roots are three or four feet long, flexible, about the size of a quill, somewhat wrinkled longitudinally, and with few or no filaments. The epidermis is generally of a brownish-gray color; the inner bark is whitish, brownish, or reddish; the woody part is very thin, and in its centre is a white medulla or pith which abounds in starch. When broken it emits a slight but peculiar odor, which is more evident when it is boiled; and when chewed its taste, which is at the same time mucilaginous and somewhat acrid, excites a flow of saliva. This peculiarity is due to a principle called *sarsaparillin*, or *smilacine*, which resides chiefly in the cortical portion of the root, whence it can be extracted by boiling water, or still better by alcohol. Sarsaparillin is white, crystallizable, and inodorous, has a bitter, acrid, and nauseous taste in solution; is almost insoluble in cold water, is soluble in hot water, to which it imparts the property of frothing, and still more so in hot alcohol, ether, and the volatile oils. It is readily dissipated by heat, which accounts for the inertness of the preparations of sarsaparilla made by boiling.

History.—The Spaniards first brought sarsaparilla to Europe about the middle of the sixteenth century, from Peru, St. Domingo, and Brazil. It was mentioned by Nicolas Massa as early as 1532, and by Prosper Alpinus, the Venetian, in 1591.[2] Astruc says, "it is thought" to be a specific for secondary venereal complaints, especially those of a rheumatic form; and Fallopius asserts that, although milder than guaiacum, it cures ulcers and fissures of the

[1] Journ. f. Pharmakodyn., i. 583.
[2] Medicina Ægypt., ed. nova, p. 253.

anus "twice as rapidly."[1] It had, however, fallen into neglect, when, about the middle of the last century, the success of a secret medicine for syphilis which Dr. W. Hunter suspected to contain sarsaparilla, induced him to make use of the drug. He found it to answer his expectations, and having communicated the result to Dr. Fordyce, the latter became convinced of its value, and published an account of his observations.[2] Thenceforth it continued to be recognized as an antisyphilitic medicine, but it has probably been more largely used by charlatans and nostrum-vendors than by physicians.

The following are officinal preparations of sarsaparilla:—

DECOCTUM SARSAPARILLÆ COMPOSITUM.—*Compound Decoction of Sarsaparilla.*

Take of Sarsaparilla, sliced and bruised, *six troyounces;* Bark of Sassafras Root, sliced, Guaiacum Wood, rasped, Liquorice Root, bruised, each, *a troyounce;* Mezereon, sliced, *one hundred and eighty grains;* Water, *a sufficient quantity.* Macerate, with four pints of water, for twelve hours; then boil for a quarter of an hour, and strain, with additional water, to make the decoction measure four pints. Dose, from four to six fluidounces three or four times a day.

EXTRACTUM SARSAPARILLÆ FLUIDUM.—*Fluid Extract of Sarsaparilla.*

Sixteen troyounces of sarsaparilla, in moderately fine powder, are treated with glycerin, alcohol, and water to the production of a pint of fluid extract. Dose, two to four fluidrachms.

EXTRACTUM SARSAPARILLÆ COMPOSITUM FLUIDUM.—*Compound Fluid Extract of Sarsaparilla.*

Take of Sarsaparilla, powdered, *sixteen troyounces;* Liquorice Root and Bark of Sassafras Root, powdered, each, *two troyounces;* Mezereon, powdered, *three hundred and sixty grains;* Glycerin, *half a pint;* Water and Alcohol, each, *a sufficient quantity.* The mixed powders are treated as in the preparation of the simple fluid extract. Dose, thirty minims to a fluidrachm.

SYRUPUS SARSAPARILLÆ COMPOSITUS.—*Compound Syrup of Sarsaparilla.*

Take of Sarsaparilla, *twenty-four troyounces;* Guaiacum Wood, *three troyounces;* Pale Rose, Senna, Liquorice Root, each, *two troyounces,* and all in moderately fine powder; Oil of Sassafras, Oil of Anise, each, *five minims;* Oil of Gaultheria, *three minims;* Diluted Alcohol, *a sufficient quantity;* Water, *a pint;* Sugar, refined, *ninety-six troyounces.* The solid ingredients, except the sugar, are macerated in diluted alcohol for four days, and then treated with the same by percolation to the production of six pints of tincture. This is evaporated to three pints, to which the water is added, the sugar is dissolved in it by the aid of heat, and the oils thoroughly mixed with it.

[1] LUISINI, Aphrodisiacus, p. 805. [2] Med. Obs. and Inq., 1755, i. 149.

A simple infusion is to be preferred, if the virtues of sarsaparilla alone are to be employed, but the most efficient preparation in the treatment of constitutional syphilis, is the compound decoction.

A favorite form for employing sarsaparilla in Germany, is the decoction of Zittman. (Vid. *U. S. Dispensatory*.) This is of two kinds, the stronger and the weaker. Of the former, the patient is required to drink eighteen ounces every morning before rising, and of the latter, thirty-six ounces every afternoon, and of the stronger decoction, again, eighteen ounces every evening, during four or five days. This preparation contains a sensible quantity of mercury.

Action.—The operation of the active principle of the root and that of other preparations of the root itself, when given in equivalent doses, are identical. According to Palotta, six grains of sarsaparillin occasioned malaise and slowness of the pulse; eight grains, nausea and constriction of the throat; ten grains further produced a sense of general debility, and, at the end of half an hour, perspiration; thirteen grains gave rise to moderate vomiting of a bitter liquid, with irritation and constriction of the throat, faintness, and general exhaustion.[1] In like manner, Hancock found that a decoction of four ounces of sarsaparilla occasioned nausea, vomiting, depression of strength, and disinclination to exertion. The pulse, also, was somewhat lowered. Hjort observed, as the effects of a saturated decoction of the root, nausea, anorexia, constriction of the throat, heaviness of the limbs, weariness, and headache.[2] These effects of sarsaparillin and of large quantities of the decoction of sarsaparilla agree in all essential particulars, and do not differ from those which Pereira observed to follow large doses of the powdered root. The effects, however, of medicinal doses of the drug, as might be expected, are not so immediate or decided. They are manifested during a state of disease, rather than in health, and consist of an improved condition of the digestive and nutritive functions, and the gradual subsidence of the morbid derangement. The diaphoretic and diuretic actions ascribed to sarsaparilla appear to be chiefly due to the quantity of fluid in which it is usually taken, and the circumstance of the skin being warm or cool at the time. Böcker concludes from his experiments with this substance, that it is neither diuretic nor diaphoretic, and that there is no evidence of its augmenting any secretion whatever.[3] The absence of decided phenomena during its ordinary administration, and the evidence above adduced to show that its action is not merely negative, entitle the medicine to rank as an alterative. Whether it acts by "purifying the blood," according to the old phraseology, now become the popular one, or in what other manner, has not yet been determined.

Uses. *In syphilis.*—When Fordyce reviewed the use of sarsaparilla in the middle of the last century, he stated that it had fallen into disrepute, and by degrees was almost forgotten, insomuch that

[1] GIACOMINI, op. cit., p. 306. [2] STRUMPF, Handbuch, ii. 330.
[3] Journ. f. Pharmakodynamik, ii. 30.

some of the greatest masters in medicine asserted that its decoction was no better than barley-water. He claimed that it restores the appetite and digestion even where the patient has become hectic from a venereal cause, and that it shows its greatest efficacy in relieving pains from venereal affections of the bones. Still, on the whole, he admits that it can be depended upon only when mercury has preceded or is associated with it.[1] Such was also the opinion of Dr. Donald Monro, who, with Fordyce, contributed to its introduction from Portugal into England. Cullen went still further, and said, "If I were to consult my own experience alone, I should not give this root a place in the Materia Medica; for, tried in every shape, I have never found it an effectual medicine in syphilis or any other disease."[2] John Hunter, speaking of the effects remaining after syphilis is cured, and of the diseases sometimes produced by the cure, says: "A decoction of the woods, among which are commonly included guaiacum and sarsaparilla, is one of the first medicines in the cure, and many of the cases yield to it, which gives them the credit of curing the venereal disease . . . but it was observed at last that those medicines did not cure this disease, till mercury had been given, and in tolerably large quantity. . . . Sarsaparilla appears to have no effect till mercury has done its best or its worst."[3] So Richter says of this medicine, "Miracles are not to be expected from it, and not uncommonly it leaves one in the lurch. Very often it produces only an apparent improvement, and after a time the disease breaks out anew."[4] Nor if we come to a more recent date, does the evidence vary. Ricord tells us that "it is far from possessing all the power which has been attributed to it, and which commercial interests struggle to maintain;" and speaking of the class of medicines to which it belongs, he remarks that they may be useful as adjuvants to a mercurial treatment when the cutaneous functions are feebly performed, and that they may be advantageous when mercury would be contraindicated, or must be temporarily suspended. Finally, "in diseases of the bones, especially with suppuration, they are often the sole resource, if not because they are really active and curative, yet because they have a popular reputation, and the patients have faith in them; they therefore constitute a *mental* medicine."[5] Of similar import is the statement of Oesterlen: "In syphilis it is of little or no use, yet it is one of those medicines which the judicious and prudent physician will employ rather than do nothing;"[6] and Clarus, after referring to an obstinate case of syphilitic rupia which recovered under its use, remarks that it is of less advantage in affections of the throat and of the bones. "It is true," he says, "that during the treatment the patients improve, but they seldom get quite well. Its most striking effects appear to be in those cases

[1] Med. Obs. and Inquir., i. 171, 180. [2] Mat. Med., ii. 200.
[3] A Treatise on the Venereal. BUMSTEAD's Am. ed., p. 477.
[4] Ausfürliche Arzneim., i. 139. [5] Malad. Vénériennes, p. 619.
[6] Heilmittellehre, 4te Aufl., p. 588.

where the patients have led a thoroughly dissolute life, exposed to vicissitudes of heat and cold, drinking deeply, and using the voice vociferously. Such persons improve rapidly in a hospital, but their improvement is owing less to sarsaparilla than to rest, good food, and a regular life. They soon relapse on returning to their former habits."[1] Finally, Böcker, in his Essay upon this subject, shows by an analysis of the history of syphilis since sarsaparilla was first introduced, that there is no evidence whatever of its having displayed any curative properties in the disease, independently of the water with which it is taken in decoction, and the other more active medicines with which it is uniformly associated.[2]

These citations suffice to show what are the opinions of those who have had most experience, respecting the virtues of sarsaparilla in constitutional syphilis. It is not competent to the cure of this affection, but it tends so far to promote the healthy action of all the functions as to enable it to co-operate usefully with mercury in the secondary, and with iodine in the tertiary forms of the disease, particularly when the cachectic state of the system renders the continued use of the former of these remedies injudicious, and of the latter insufficient. The common error of expecting from a remedy more than it is able to effect, has tended almost to banish sarsaparilla from the treatment of constitutional syphilis, and yet, no doubt there are many cases now, as there always have been, which will not improve under the use of mercury or of iodine, but which get well under the appropriate administration of the "decoction of the woods," taken in the large doses which alone were used at the time when these medicines were most in vogue for the treatment of constitutional syphilis. It is more than probable that the cachectic state of the system which resists other remedies is due, in many cases, less to the original disease than to the mercury which saturates the patient's system, and that whatever tends to hasten its elemination tends also to effect the patient's cure. The history of syphilis abounds with proofs that upon this power in sarsaparilla and its associated medicines depends their value in the treatment of the disease, and it is probable that they will resume more or less of their former importance if mercury should ever again be employed as lavishly as it used to be.[3]

In other chronic affections of a *scrofulous*, *rachitic*, *rheumatic*, or *gouty* character, which are characterized by a general derangement and impairment of the health, in connection with the local phenomena of some one or more of these diseases, it is very probable that a protracted course of decoction of sarsaparilla may be beneficial, but as much, perhaps, by the quantity of liquid that is taken, as by any medicinal principle that the preparation contains. It is also to be remembered that the simple decoction of sarsaparilla is very seldom employed alone. The preference is always given to one of those compounds which contain mezereon, guaiacum, or

[1] Arzneimittellehre, p. 469. [2] Journ. f. Pharmakodyn., ii. p. 37 et seq.
[3] Compare ALLBUTT, Practitioner, iv. 257; DA CUNHA, Ibid., v. 190.

a; and most frequently the iodide of potassium, or some other active medicine, is administered besides. If a cure ensues under such circumstances, the share which sarsaparilla takes in it must be problematical indeed.

CHLORINIUM ET CHLORINIA.	Vid. *Irritants.*
COLCHICUM.	" *Diuretics.*
DULCAMARA.	" *Sedatives.*
GUAIACUM.	" *Diaphoretics.*
MEZEREON.	" *Irritants.*

INDEX OF MATERIA MEDICA.

INDEX OF THERAPEUTICS.

INDEX OF THERAPEUTICS.

ERRATA.

Vol.	Page	For		Read
Vol. i.	194	Ceratrum,	*read*	Ceratum.
"	214	tympanitis,	"	tympanites.
"	298	*annuiare,*	"	*annuaire.*
"	346	tympanitis,	"	tympanites.
"	356	*syphilitic,*	"	syphilitic.
"	493	QUINIA,	"	QUINIÆ.
"	557	esculine,	"	esculin.
"	898	$\frac{}{100}$,	"	$\frac{1}{100}$.
Vol. ii.	134	form,	*read*	forms.
"	193	Sodæ Boras,	"	Sodii Boras.
"	300	indangers,	"	endangers.
"	303	Antimonii et Potassæ Tartras,	*read*	Antimonii et Potassii Tartras.
"	581	Ammoniæ,	*read*	Ammonii.
"	619	potassa,	"	potassium.
"	839	Browardel,	"	Brouardel.

POSTSCRIPT.—In the article on CHLOROFORM, it is stated (vol. ii. p. 146) that death from this agent may be due either to asphyxia or to syncope. For the latter accident various stimulants are mentioned as appropriate remedies, but the most rational of all, and perhaps the most efficient, was unknown to the author when the text was written. There is now reason to believe that the true remedy for this condition of imminent or even apparent death has been discovered by NÉLATON to consist in immediately placing the patient's head in a depending position, as is done in cases of syncope from hemorrhage. The subject was elucidated in some remarks by Dr. J. Marion Sims, before the British Medical Association in the summer of 1874—*Philadelphia Medical Times*, Sept. 10th, 1874.

THE END.

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